UNIVERSITY OF AGDER

Utilising Local Knowledge for Climate Change Adaptation

A Case Study of the Lake Chilwa Basin Climate Change Adaptation Programme (LCBCCAP), Malawi.

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This Master's Thesis is carried out as a part of the education at the University of Agder and is therefore approved as a part of this education. However, this does not imply that the University answers for the methods that are used or the conclusions that are drawn.

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Abstract

It has been argued that local knowledge should be incorporated into climate change adaptation programmes in order to produce appropriate adaptation strategies. How local knowledge can and should be utilised is the topic if the study. The Lake Chilwa Climate Change Adaptation Programme aims to secure the livelihood of the 1.5 million people living in the Lake Chilwa Basin in south-eastern Malawi, by introducing adaptation and mitigation strategies. The assessment of how LCBCCAP and the Women Fish Processing Groups (WFPGs) utilises local knowledge brings great insight ways in which local knowledge can enhance climate change adaptation. The WFPG utilised local knowledge through participatory means such as participatory research and participatory management. The findings indicate that the WFPG-project is rich in local content and specifically target local issues. The participation of the community has increased sustainability and efficiency, improved communication and reduced the chance of conflicts. Further, utilising local knowledge has empowered the beneficiaries as they experience that their opinions, involvement and perceptions are valued. The challenges that were identified regards knowledge-conflict between 'local knowledge' and 'scientific/western knowledge' and the issue of validating local knowledge. It is argued that for local knowledge to be beneficial, it needs to be exactly that – *local.* Local knowledge should not be taken out of context and generalised to be implement elsewhere. The WFPG-project is a good example of a project that has a rich local foundation and is improved with technical solutions. This way, local practices and scientific knowledge can complement each other. The findings indicate that by involving the stakeholders in identifying adaptation strategies and together adapted them to fit into the local context local knowledge may indeed enhance climate change adaptation programmes. Further, the findings indicate that climate change may affect the most fundamental needs for rural poor in the Lake Chilwa Basin, their food security and their livelihood. This is due to their overdependence of natural resources. Encouraging diversification of livelihood strategies that are not based on natural resources is identified as a recommendation in order to enhance adaptive capacity to present and further climate variability and change.

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Acronyms and Abbreviations

ADC – Area Development Committee
BVC- Beach Village Committee
CBA – Community-based adaptation
CBO – Community-based organisations
CAF – Cancun Adaptation Framework
COP – Conference of the Parties
DCCMS – Department of Climate Change and Meteorological Services
DoF – Department of Fisheries
EAD – Environmental Affairs Department
FRIM – Forest Research Institute of Malawi
GDP – Gross domestic product
GNI – Gross national income
GoM – Government of Malawi
IPPC – Intergovernmental Panel on Climate Change
LCBCCAP – Lake Chilwa Basin Climate Change Adaptation Programme
LDC – Least Developed Countries
LEAD– Leadership for Environment and Development
MNREE – Ministry of Natural Resources, Energy and Environment
MoDPC – Ministry of Development Planning and Cooperation
NAPA- National Adaptation Programmes of Action
NGO – Non-governmental organisation
NSO – National Statistical Office
PPP – Purchasing Power Parity
PRA – Participatory Rural Appraisal
RRA – Rapid Rural Appraisal
UNESCO - United Nations Educational, Scientific and Cultural Organization
UNEP – United Nations Environment Programme
UNDP – United Nations Environment Programme
UNFCCC – United Nations Framework Convention on Climate Change
VDC – Village Development Committee
WFC – WorldFish Centre
WFPG – Women Fish Processing Groups

Chapter One: Introduction

Introducing Local knowledge to Climate Change Adaptation

It is no longer disputed whether climate change is happening and if it is human-induced. Rather the discussion has moved towards how to mitigate climate change, and to a growing extent, how to adapt to the anticipated changes (Adger 2003:387). At the thirteenth Conference of Parties (COP 13) of the United Nations Framework Convention on Climate Change in Bali 2007, adaptation was acknowledged as one of the four 'building blocks' required to respond to climate change alongside mitigation, technology cooperation and finance (Dodman and Mitlin 2011:2). There are a growing number of climate change adaptation programmes taking form as adaptation has been recognised as a crucial strategy to deal with the current and future climate changes. Many of these programmes will take place in developing countries, as they are especially vulnerable and exposed to climate change (Adger et al. 2003:180-181).

While adaptation is no new topic, adaptation to climate change is still a fairly new issue in development studies and lessons should be drawn from previous experiences (Dodman and Mitlin 2011:5). Top-down approaches in development have shown inadequacies in knowledge of local contexts. Bottom-up approaches that have emphasised participation of community members and where local knowledge and expertise have been considered have often proved more sustainable (Blanco 2006:140). In the field of sustainable development the importance of local knowledge has already been acknowledged and scholars (Adger 2003, Blanco 2006, Nyong et al. 2006) as well as development agencies are now seeing the same need for the inclusion of local knowledge in climate change adaption. According to Nyong et al. (2007), including local knowledge into adaptation policies and programmes lead to effective adaptation strategies that are "cost-effective, participatory, and sustainable (Nyong et al. 2007:788).

Lake Chilwa Basin Climate Change Adaptation Programme (LCBCCAP) in Malawi is an adaptation programme that is designed around these premises. The programme is implemented by Leadership for Environment and Development (LEAD), WorldFish Centre (WFC) and Forestry Research Institute of Malawi (FRIM) and seeks to "secure the livelihood 1.5 million people living in the Lake Chilwa Basin and enhance resilience of the natural resource base (LEAD 2011:6)". LCBCCAP encourages involvement of community stakeholders from the very start and throughout the programme through participatory adaptive

research and participatory management (LEAD 2011:8). The programme is therefore an ideal case to assess in order to gain an in-depth understanding of the possibilities for local knowledge in climate change adaptation. LCBCCAP facilitates numerous projects. The study will assess how LCBCCAP utilises local knowledge related to one specific project: The Women Fish Processing Groups (WFPGs).

Research Objective and Questions

As scholars are arguing for the importance of including local knowledge in climate change adaptation it is necessary to develop an understanding of ways in which local knowledge can be used in adaptation programmes. The main objective of the study is therefore *to understand how local knowledge can be utilised to enhance climate change adaptation programmes*. For the purpose of gaining an understanding of the contextual background of climate change in the Lake Chilwa Basin and how the local people are affected and to understand if the LCBCCAP is successfully reducing the people's vulnerability to climate change the following sub-objectives are:

- To document the WFPG members' experience with climate change in order to understand the challenges rural poor face in Lake Chilwa Basin
- And to assess if and how LCBCCAP´s Women Fish Processing Groups increases the members adaptive capacity towards climate change.

In order to meet the objectives, the following research questions will be answered:

1. To what extent have the women in the Women Fish Processing Groups experienced changes in the climate, what have they experienced and how have they been affected by it?
2. To what extent does LCBCCAP increase the Women Fish Processing Groups members' adaptive capacity?
3. To what extent has LCBCCAP utilised local knowledge and how does it affect the programme and its beneficiaries?

Relevance of Study

According to Nyong et al. (2007:794) very little attention has been given to the value of local knowledge in climate change studies. This study will therefore contribute to an area with little academic writing. The focus is on adaptation programmes that are implemented at the community level. Further, the study is of great importance for academia and policy makers as it is important to increase the knowledge-base about how rural poor living in southern Africa are affected by climate variability and climate change. Malawi has been recognised as a country that is especially vulnerable to climate change because of the economy's and population's dependence on agriculture and subsistence farming (EAD 2006:xi). Increase in climate variability is already threatening the country's food security and it is pushing the rural poor further into poverty. Understanding Malawi's and more specifically the rural populations experience with climate variability will help guide further research and the development of relevant adaptation programmes to reduce rural poor's vulnerability towards the impacts of climate change.

Thesis Outline

The study is organised into eight chapters. Chapter one presents the topic and the research questions followed by the relevance of study, thesis outline and a brief introduction into the methodology of the study. Chapter two is divided into two parts. Part one gives a contextual overview over Malawi and the Lake Chilwa Basin, the specific study area of the study. The scientific evidence of Malawi's and the basin's experience with climate variability and change are also presented. Part two provides background information of LCBCCAP, WFPG-project and its members. The literature review and theoretical framework is presented in chapter three, which gives a presentation of relevant theories, concepts and frameworks. These will be used when presenting and analysing the findings of the study. Chapter four introduces the methodology of the study. The three next chapters' answers to the research questions by presenting the findings and discussion combined. Chapter five will answer to the first research question and describe the experiences the WFPG members have had with climate change in the Lake Chilwa Basin. By focusing on their experiences and perceptions the chapter will outline how they and the natural resources they depend on have been affected by the changes. This will provide background information about the situation in the basin and how climate change affects rural poor in Malawi. Chapter six will answer to the second research question by assessing if the women's adaptive capacity has increased by participating in the

LCBCCAP. This will give an indication of whether or not the project is successful and it will provide important information for the following chapter. If the WFPGs are successful, is this related to LCBCCAP utilising local knowledge? Local knowledge is the topic of chapter seven and it will answer to the last research question by documenting how LCBCCAP utilises local knowledge. The question will then again be asked how does utilising local knowledge in a climate change adaptation affect the programme and its beneficiaries, in this case the WFPG members and further, what lessons can be learned from LCBCCAP about utilising local knowledge for climate change? Together the three chapters will ensure that the main and sub-objectives are met. Chapter eighth summarises the thesis and provides insight into limitations and suggestions to further research.

Methodology in Brief

The study falls within social science research and a qualitative research approach has been chosen, as it is believed that it will better equip the researcher to meet the objective. The research has been conducted as a case study on the LCBCCAP with focus on three WFPGs. The focus is nevertheless on the whole WFPG-project within the LCBCCAP and the three groups are therefore treated as one case. The purpose of including three groups is not to compare them, but to gather as much data as possible on the project. The data collection methods that were used are semi-structured interviews, focus groups, non-participant observation and collection and review of relevant documents. The sampling framework is restricted to two of the organisations implementing the LCBCCAP: LEAD and WFC, one of LCBCCAP partners: staff from the Department of Fisheries (DoF) and members from the three WFPGs.[1]Both methodology-triangulation and information-triangulation has been used in order to ensure a clearer picture of the project and to be able to crosscheck and compare responses.

[1] Leadership for Environment and Development- Southern & Eastern Africa (LEAD-SEA) is implementing the LCBCCAP. However, LEAD-SEA is referred to throughout the thesis as LEAD.

Chapter Two: Contextual Overview

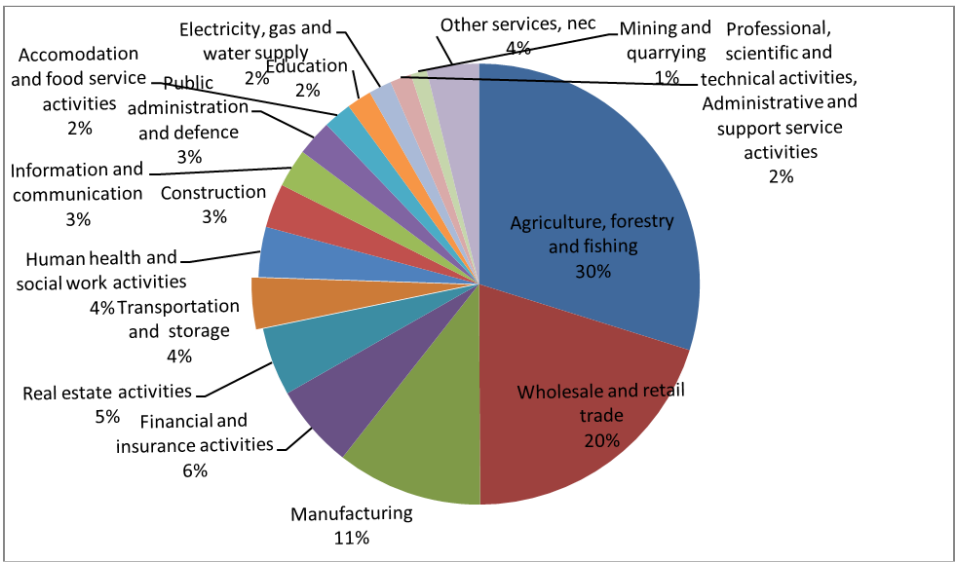
Chapter two is divided into two parts. Part one gives a contextual overview of Malawi and the study area and presents the scientific results of studies on climate change related to Malawi and the Lake Chilwa Basin. Part two introduces the Lake Chilwa Basin Climate Change Adaptation Programme (LCBCCAP) and more specifically the Women Fish Processing Group (WFPG) project.

Part One: Malawi, the Lake Chilwa Basin and Climate Change

Malawi

Malawi is one of the smaller countries in Sub-Saharan Africa, landlocked between Mozambique, Zambia and Tanzania. Nyasaland, as it was previously known, was under British rule from 1891 to 1964 when it gained its independence. After three decades of one-party rule Malawi held its first multiparty elections in 1994. Joyce BANDA became the president of Malawi in April 2012 after the former president, Bingu wa MUTHARIKA, passed away (CIA 2012).

Figure 2.1: The 2007 GDP by activity



Source: GoM (2011:1)

With a population of approximately 15,380 000 on an area of 94,276 square kilometres, Malawi is also one of the most densely populated countries in Africa (EAD 2010:4, UNDP 2012). It is also one of the least-developed countries (LDCs) with a gross national income

(GNI) of USD 850 purchasing power parity (PPP) per capita (compared to Norway with USD 56,830) and ranks as 171 out of 179 on UNDP's human development index (UNDP 2011).

The country's economy is predominantly agricultural and Malawi depends on just a few cash crops. As seen in figure 2.1, one-third of the country's gross domestic product (GDP) comes from agriculture, forestry and fishing. Table 2.1 presents Malawi's export commodities in which agricultural commodities such as tobacco, tea and sugar dominate. Together they constitute nearly 80 per cent of Malawi's exports.

Table 2.1: Export commodities 2010

Export commodities	Value (K'mn)	Percentage
Tea	12078,6	8,6 %
Tobacco	87490,4	62,2 %
Cotton	1751,5	1,2 %
Sugar	10324,3	7,3 %
Uranium	17093,2	12,2 %
Pulses	2304,3	1,6 %
Rice	133,2	0,1 %
Coffee	3111,3	2,2 %
Nuts	1073,8	0,8 %
Spices	319,1	0,2 %
Beverages, Spirits and Vinegar	1083,4	0,8 %
Natural Rubber	1432,6	1,0 %
Wood Saw and Plied	1666,3	1,2 %
Live Trees	26,3	0,0 %
Cotton Fabrics	89,7	0,1 %
Skin and Hides	97,7	0,1 %
Woven Fabrics of Staple Fibres	142,2	0,1 %
Apparel Clothing Knitted	364,2	0,3 %

Source: (GoM 2010:79)

Malawi's reliance on few cash crops makes the country's economy vulnerable to changes in the world market price and demand. The tobacco industry, which accounts for over 60 per cent of Malawi's export, has seen a drop in prices and demand in the recent years. The drop in export and prices has a serious effect on Malawi's foreign exchange reserve which further complicates Malawi's development. One example is the fuel shortages Malawi has been facing for the past two years. Further, the tobacco industry also depends on climate stability. In February 2012, The Tobacco Association of Malawi stated that they expected the country's tobacco production to go down by as much as 50 per cent of the projected production for 2012 as a result of erratic rains during the early months of the season (Malawi Times 2012).

Malawi is highly vulnerable to the effects of climate change and variability in the rainy season due to the country's dependency on natural resources. Changes such as rainfall onset, dry spells and distribution patterns can seriously jeopardise the country's economy (EAD 2010). Such changes also threatens the country's food security and puts further pressure on Malawi´s poor as most households rely on subsistence rainfed farming for their livelihood (Kalanda-Joshua et al. 2011:996). Climate change may therefore threaten the majority of Malawi's population, of whom approximately 90 per cent live in rural areas (Stringer et al. 2009:9).

Malawi and Climate Change

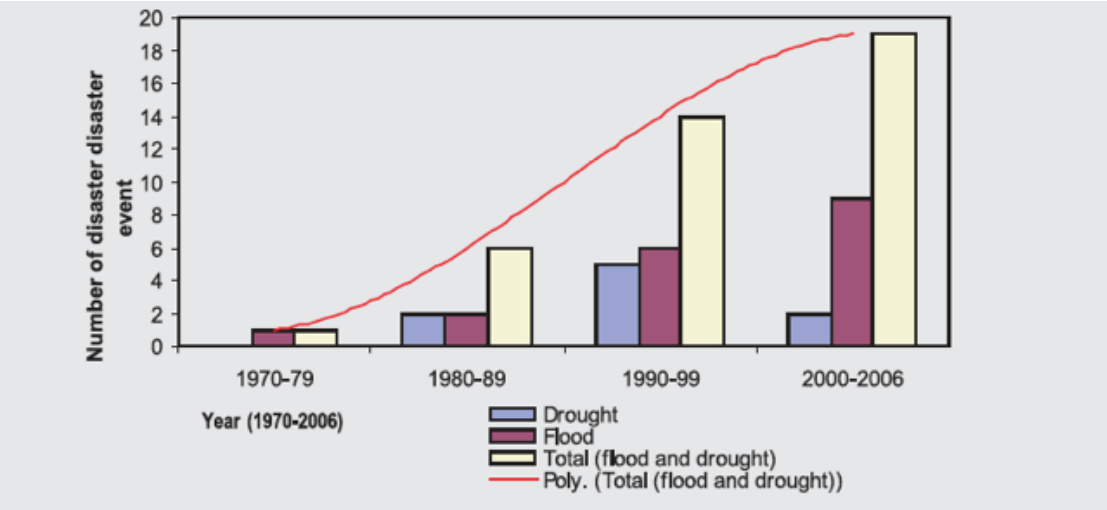
There have been some studies conducted on Malawi and climate change. The United Nations Environment Programme (UNEP) defines climate change as "any changes in the climate over time, whether due to natural variability or as a result of human activities" (UNEP 2007:517). According to Intergovernmental Panel on Climate Change (IPPC) the resent changes in the climate should be viewed as a consequence of anthropogenic emissions. Climate change should nevertheless not be confused with climate variability. While climate change causes long term or permanent changes over a vast area, climate variability will appear over a shorter period and the effects will be found in a smaller area (MNREE 2010:214). There is still no consensus if the changes that Malawi is experiencing should be understood as climate change or climate variability, but studies have found some significant changes, especially in regard to temperature.

UNDPs Climate Change Country Profile concludes that Malawi is experiencing an increase in mean annual temperature. From 1960 to 2006 the mean annual temperature has increased by 0.9°C. It is predicted that the temperature will continue to rise by 1.1 to 3.0°C by the 2060s and further by 1.5 to 5.0°C by the 2090s. UNDP found no statistically significant trends in precipitation. The future predictions of annual rainfall show no substantial change but it is predicted that it will fall over a shorter period causing heavier rainfall events. It is however noted that the different models predict a wide range of possible outcomes. This is due to Malawi's geographical position, located as it is between two regions of opposing climatic response to El Niño. Eastern equatorial Africa usually receives above average rainfall during El Niño while south-eastern Africa tends to experience below average rainfall. La Niña normally cause the opposite effect (McSweeney et al. 2012).

A study conducted by the Department of Climate Change and Meteorological Services (DCCMS) in Malawi, found that there are some long-term changes in precipitation and a general decrease in precipitation is documented, but regional variations are also found. Just as UNDP, they conclude that the mean temperature in the whole country is higher than it was two decades ago with warmer winters and summers (EAD 2010:218).

Further, when debating climate change it is often stated that extreme events will increase. IPCC claims that there is not yet a sufficiently developed instrument to make possible conclusions about whether extreme events have increased globally and thus they can only answer to individual extreme events (IPCC 2012:125). For Malawi an increase in extreme events would mean an increase in dry spells, seasonal droughts, intense rainfall, riverine floods and flash floods (Njaya et al. 2011:22). A study conducted by ActionAid (2006) reports that the country has already seen an increase in the number of extreme weather events in terms of floods and drought since the 1970s till 2006. The findings are illustrated in figure 2.2 which shows an increase of total events[2].

Figure 2.2: Flood and drought in Malawi 1970 to 2006



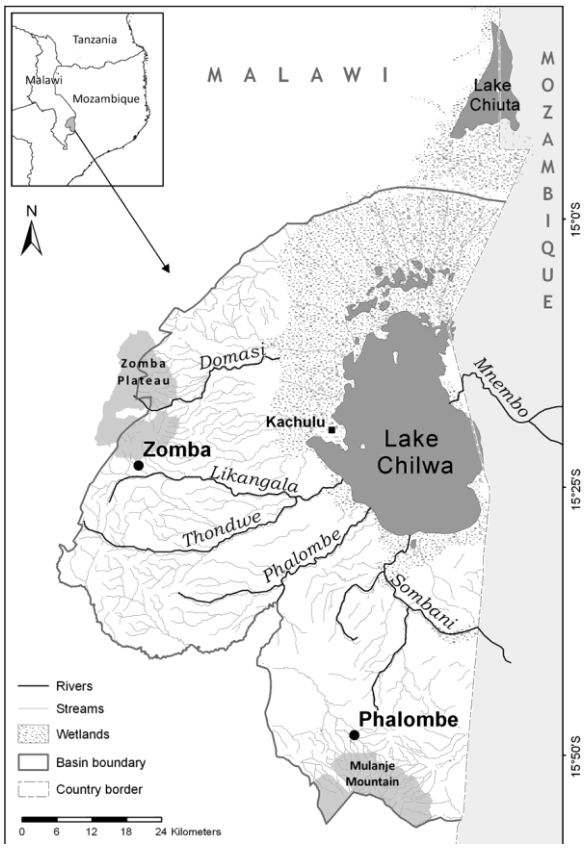
Source: Action Aid (2006)

[2] There may, however, be reasons to question their findings as the report indicates that the figure is an outcome of people's experiences supported by a systematic record of data. It does not, however, indicate what records they have used.

Lake Chilwa Basin

The study was conducted in the Lake Chilwa Basin, situated in south-eastern Malawi, bounded by Zomba Mountain to the west, Mulanje Mountain to the South and Chikala Hills to the north (Chiwaula and Chaweza 2010:1). LCBCCAP operates in all three districts of the basin, Zomba, Phalombe and Machinga.

Map 2.2: The Lake Chilwa Basin



Source: Njaya et al. (2007:17)

Socio-Economic Issues

The Lake Chilwa Basin is predominantly rural with low levels of development. It is not only one of the poorest regions in the country, but arguably in all of Africa. Seventy to 80 per cent of the 1.5 million people who live in the basin are below the poverty line, and 37 to 50 per cent are considered as ultra-poor (Njaya et al 2011:17).[3] Besides Zomba city in Zomba District, the three districts are almost entirely rural and people have poor access to social services such as education and health facilities. Some of the main challenges in the areas are therefore low levels of education and literacy, low income, high mortality and high morbidity rates. Due to high fertility rates (rural 6.3) and low life expectancy (male 47.4, female 50.6), Malawi has a young population with nearly 50 per cent being younger than 18 years old (EAD 2000:14, GoM 2010:vii).

Another factor that is putting pressure on development in the region and the country is the high population density in the basin. Phalombe and Zomba have one of the highest population densities in the country at 225 and 228 people per square kilometre, compared to a national average at 139 people per square kilometre. With an annual growth rate of 2.4 per cent in the

[3] In Malawi, the poverty line is set at 58 Malawi Kwacha (44 U.S cents at 2009 exchange rate) per person per day, which is based on the cost of the minimum calorie requirements plus some basic non-food items. The ultra-poverty line is set at 35.5 Malawi Kwacha (25 U.S cents at 2009 exchange rate) (Njaya et al 2011:17).

southern region the population will continue to increase rapidly (GoM 2010).

In addition to putting pressure on the social systems and infrastructure, population growth is also straining the natural resources that the majority of the people in the basin directly rely on, threatening people's livelihoods and the basin's food security. About 79 per cent of the people depend on natural resources. Sixty per cent are farmers, 9 per cent work in the fish sector, 8 per cent diversify their income by combining farming and fishing and about 4 per cent through farming and petty trading (EAD 2000). Most households depend on their own crops for food throughout the year. However, due to limited agricultural land nearly all families run out of food during the last months before harvest starts.[4] According to a study done by the Government of Malawi the annual harvest is only enough to sufficiently support families for about half a year. By the end of the year 93 per cent run out of food (Njaya et al. 2011:17). In recent years erratic rain has increased food shortage and reduced income, as farmers depend on consistent rainfall throughout the rain season for a good harvest. The rain season is from November to March and during the dry season nothing can be grown except under irrigation, which is unavailable for most people (Njaya et al. 2011:16).

In recent years deforestation has become a growing problem all over Malawi. As 88.5 per cent of energy supply in Malawi comes from fuel wood and 98 per cent of rural households use fuel wood for cooking (EAD 2010:48) trees are being cut down at a fast pace. While new data is missing, Malawi's State of Environment and Outlook (EAD 2010:143) reports that in 1973 Brachystegia forest covered 45 per cent of total land area.[5] 19 years later the percentage was reduced to 25.3. The total forest cover is estimated to be declining by 1 to 2.8 per cent annually. Another resource that is in danger of being over-exploited and is threatened by the climate variability is Lake Chilwa.

Lake Chilwa

Lake Chilwa is the second largest wetland in Malawi and because of its rich biodiversity the lake became a Ramsar site in 1997.[6] As seen in figure 2.3, the lake's water level is slowly

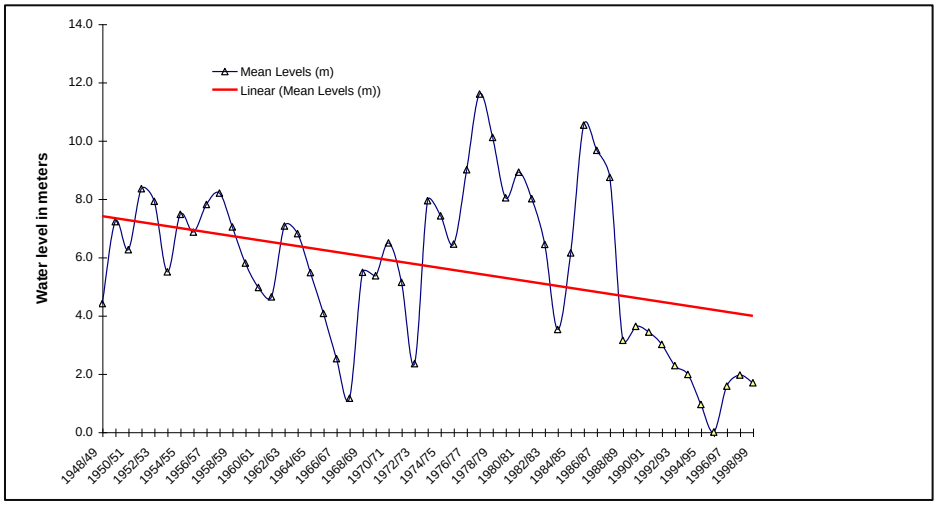
[4] About 44 per cent of households have less than 1 hectare of land (Njaya et al. 2011:17)
[5] Brachystegia is a genus of tree of the sub-family Caesalpinioideae that is native to tropical Africa (Wikipedia 2011)
[6] The Ramsar Convention, also known as the Wetland Convention, is an intergovernmental treaty "that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International

decreasing. In 1972-73 the average depth of the lake was six meters. However, about 200 years ago the lake level was nine meters than it is at present level. Now it has an average depth ranging between 1.5 and 2.5 meters and reaches no deeper than 5 meters. (Njaya et al. 2011:16). This means that even a small reduction in water level reduces the size of the lake considerably. The lake is a closed drainage lake, meaning that no water flows out of the lake. Thus, the water level is a direct result of the amount of rainfall that falls during the annual rain season and the amount of water that evaporates. Because it is a closed drainage lake, Lake Chilwa shows considerable variability in the water level. The records show an annual halving of lake volume with an annual variability in lake level of ca. 0.8-1.2 meters in a 'normal' year and almost complete drying of the lake at inter-decadal (ten to twenty years) time periods. Because Lake Chilwa is a shallow, closed lake it is prone to drying. In the past century the lake has dried nine times: 1903, 1913-1916, 1922, 1934, 1943-1949, 1967, 1973, 1975 and most recently in 1995-1996 (Chapotera 2012:2).

Drying up benefits the lake's productivity as higher fish catches are recorded in the post-drying years. According to Njaya et al. (2011:18) this is because "the drying of the lake allows for the oxidation and release of nutrition from the very large quantities of organic matter, largely derived from the surrounding *Typha domingensis*, the False Bulrush, swamps that settle on the lake bed".While the lake's productivity benefits from cyclical dry periods, the event is devastating not only for the fish sector, but the whole basin. According to Phipps (in Njaya 2011:23) "the whole of the Chilwa plain and lake must be seen as an economic network". The fish sector is arguably the engine of the basin's economy as the value of fishery is estimated between US$11 million (GoM 2009:3) and US$17 million annually (Njaya 2011:59). On a good year it can support 9000 fishermen, not counting the fish processors, traders and gear owners (Njaya 2011:59).

Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories" (Ramsar 2012)

Figure 2.3: Mean water levels of Lake Chilwa



Source: (EAD 2000:50)

Households that are involved in the fish sector are generally better off than those who are not. Most households are nevertheless dependent on the lake and the fish sector in one way or the other. Money from the fish sector is often invested in farming or other small businesses such as restaurants, shops or room rentals. The capital that the fish sector brings to the basin also keeps other businesses going (Njaya et al. 2011:18). Thus, when the lake dries up, so does the basin's economy. Furthermore, drought or poor rainy seasons that cause the lake to dry up also have a devastating effect on people´s crops, resulting in food insecurity throughout the region. In order to get by people travel long distances to buy food or migrate to other districts to find temporary jobs in other sectors. One of the concerns related to climate change is that higher temperatures and a possible reduction in precipitation will cause the lake to dry up more frequently.

Climate Change and Lake Chilwa Basin

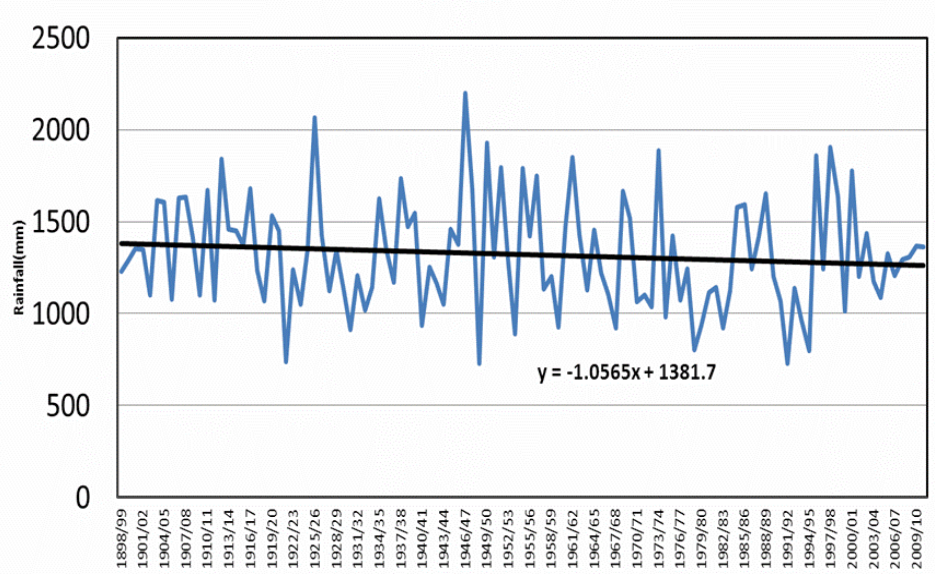
Some studies have been conducted on climate change in the Lake Chilwa Basin. It must be noted, however, that Lake Chilwa Basin is located in a climatically unstable environment and fluctuations in rainfall and temperature has been recorded since the 1960's. It is therefore not clear if the climate is changing significantly (EAD 2000). Data does however show a slight decrease in rainfall and an increase in temperature in the Lake Chilwa Basin.

Statistics from the Meteorological Department show that the mean maximum temperatures in the basin have risen by approximately 1°C. The mean minimum temperature has also risen, but to a lesser extent (EAD 2000:72). A decrease in precipitation since the mid-1980s has also

been documented in the basin as shown in figure 2.4. The combined effects of higher temperatures and less rain is arguably the reason for the gradual decrease in Lake Chilwa's water level discussed above (EAD 2000:72).

While there is a lack of scientific evidence that the climate in the basin is changing significantly, scenarios of the basin predicts that air temperatures in the basin will increase 2.6°C to 4.7°C by 2075 while scenarios of precipitation varies from a 8.3 per cent increase to a 7 per cent decrease (EAD 2000:72). Several severe incidents of extreme events have been recorded in the Lake Chilwa basin in recent years. The Phalombe flood in 1991 took 500 lives and displaced thousands of people, while the complete drying of Lake Chilwa in 1995/1996 caused the fishery industry to collapse and threatened the livelihood of everyone depending on the lake. Such events have been predicted to increase as annual temperatures are rising and rain has become increasingly unpredictable (LEAD n/a). With the present changes and the possible future changes, the people in Lake Chilwa Basin need means to adapt to the changes in the climate in order to secure their livelihood. The LCBCCAP is therefore an important programme to the basin, as it aims to do just this.

Figure 2.4: Seasonal rainfall time series Zomba



Source: Carr (2012)

Part Two: Insight into LCBCCAP and WFPG

This section will provide background information on the Lake Chilwa Basin Climate Change Adaptation Programme and more specifically the Women Fish Processing Groups (WFPG), which is the focus of the study. The information is based on programme documents as well as findings from the fieldwork.

Lake Chilwa Climate Change Adaptation Programme

LCBCCAP is a five-year joint programme (2010-2014) implemented by Leadership for Environment and Development (LEAD), WorldFish Centre (WFC) and Forestry Research Institute of Malawi (FRIM). The programme is funded by the Norwegian Government through the Norwegian Embassy in Malawi. LCBCCAP main objective is to secure the livelihood of the 1.5 million people living in the Lake Chilwa Basin and enhance the resilience of the natural resource base they depend on. To meet the objective, LCBCCAP develop and implement basin-wide climate change adaptation strategies and works towards increasing the capacity of communities to adopt sustainable livelihood and natural resource management practices (LEAD 2011). The programme has a number of projects in the basin and one of them is the WFPG.

Women Fish Processing Group

The WFPGs are facilitated by WFC and are developed to improve household and enterprise adaptive capacity in the basin. The specific aim of the WFPG is to enhance the women's adaptive capacity through fish processing. The majority of the women participating in the programme were in the fish sector prior to the project, but by introducing new methods to process fish LCBCCAP seeks to increase the income of the women.

Fish Processing

Fish processing in rural Malawi involves drying and/or smoking fish. The fish processors usually do not fish themselves but purchase fish from local fishermen.

Drying Fish

The fish is dried on gauzing wire on poles or on the ground, or straight on rocks or cement. The traditional methods of drying fish are problematic for several reasons. Fish dried under open air and on the ground is exposed to bacteria transmitted by insects and animals. It is not possible to dry fish if it rains and fish is often spoiled due to rain or hygienic matters. The process is also time consuming, as the fish processer has to turn the fish over in order for it to dry properly and keep watch for animals and thieves.

Images 2.1: Traditional methods of drying fish

Drying fish on gauze wire in Tadala and Kachulu near Lake Chilwa

Drying fish on cement and on rock

Photos: Hanne Jørstad

The new method introduced by LCBCCAP deal with these issues by providing solar fish driers that are more effective, hygienic and reduces spoilage of fish. The constructions of the solar fish driers are similar to a greenhouse, but walls are covered with thick plastic sheets instead of glass. The new method is based on the traditional way of processing fish. The main difference is that it is conducted inside a solar drier. Due to the high temperature inside the solar driers, the fish dries faster, it does not have to be turned and higher quantities can be process. Animal and insect access to the product is also limited since the production takes

place inside, reducing transmission of bacteria. As a result the final product has a higher quality and better taste.

Images 2.2: Improved method of drying fish

Solar fish driers

Drying fish inside the solar fish drier

Photos: Hanne Jørstad

Smoking Fish

The traditional method of smoking fish is by using smoking kilns that are fuelled by firewood. The groups are introduced to new smoking kilns that can smoke higher quantities with less firewood. The construction is similar to the traditional smoking kilns, except the new kilns are larger, closed off and can smoke higher quantities.

Images 2.3: Traditional and improved smoking kilns

Traditional smoking kiln

Improved smoking kiln

Photos: Hanne Jørstad

Because the kilns are closed they require less firewood and therefore target the problem of deforestation in Malawi. It also allows the women to spend less time and money on collecting

or purchasing firewood. Table 2.2 presents the advantage of the new methods and the disadvantages of the old methods. It is obvious that the new method successfully targets the problems of the old methods. According to the WFPG members there are no disadvantages with the new methods or advantages with the old methods and none were identified through the study.

Table 2.2: Advantage of new methods and disadvantage of old methods

Advantage of new methods	Disadvantage of old method
Solar Fish Drier Increased quality Increased price Bacteria free Low wastage Better taste Satisfied customers Can be sold in formal markets High capacity Efficient: Fish dries faster	**Solar Fish Drier** Lower quality Lower price Bacteria transmission due to insects and animals High wastage Time consuming Can only be sold at informal markets
Smoking Kiln Capable of high quantity Uses less firewood Can smoke fish even if it is raining	**Smoking Kiln** Capable of low quantity Uses more firewood Cannot smoke while raining

Source: Primary data

Packaging fish

A part of the project is to enhance the value of the fish by introducing the final product to the formal market. The processed fish is commonly sold on local markets in bulk, but by packaging the product, the durability and value of the fish increases. During data collection only small quantities of the product went to formal markets as WFC was still working on identifying retailers and markets for the product. However, according to WFC, the product sells fast as there is no similar Malawian product found in grocery stores. According to the Tadala WFPG, WFC collects packaged fish ones or twice a month. At that time the women work together to dry and package fish, but for most days they work individually, contributing towards their own business. However, because they still use the equipment for their own business, the women work closely together. As WFC identifies retailers and markets, the group business will to a large extent replace the individual businesses. This will benefit the women as they may be able to get up to three times as much for packaged fish on formal markets compared to unpackaged fish on local markets.

Images 2.4: Packaging processed fish

Swang'oma WFPG packaging fish

Final product

Photos: Hanne Jørstad

Training

In addition to providing WFPG with new technical solutions, the women are also given training. They are given a wide range of courses that will assist them in producing a high quality product and to understand the context of the project. According to the women, not all groups or group members have had all the training, but the training WFC provides is: business management, fish processing, group dynamics, gender and climate change. The training is important to enhance the women's knowledge and capabilities of running a business and their understanding of climate change. Together the training increases the women's understanding of how their lives are and will be affected by climate change and what they can do in order to prepare for future hazards.

Saving

LCBCCAP encourages the women to save in order to have a backup for unexpected scenarios, including natural hazards. If the lake dries up their source of income will vanishes temporarily. The savings will then allow the women to get by. Each group is therefore in charge of setting up a group account where profits from the group work can be saved. The group themselves are in charge of the account and how to share the profit. During data collection only the Swang'oma WFPG and Tadala WFPG were using the bank accounts and they were planning to share the income between the members annually. The members of the Kachulu WFPG were using a village bank and did not think it was necessary to have a group account. However, WFC is planning to provide individual accounts for the women in the future if they manage the group bank accounts well. Compared to the village bank, the

standard banks provide better services as they give higher rates for savings and provide better rates for loans.

Introducing the Women Fish Processing Group

LCBCCAP has established three groups; Kachulu Women Fish Processing Group, Swang'oma Women Fish Processing Group and Tadala Women Fish Processing Group.

Kachulu Women Fish Processing Group

The Kachulu group is located in Kachulu, Zomba District. It was established in July 2011 and has fifteen members. Personal interviews were held with six of the group members and seven members were present for the Focus Group (FG). The group had one faulty solar fish drier, but new solar driers and smoking kilns were under construction during fieldwork.

Swang'oma Women Fish Processing Group

The Swang'oma group is located in Swang'oma, Phalombe District. It was established in June 2011 and has 12 members. Personal interviews were held with six of the group members and nine members were present during the FGD. The group had two smaller solar fish driers and two larger solar driers were under construction. The women had access to new smoking kilns, but the group used the traditional smoking kiln that was closer to the solar fish driers.

Tadala Women Fish Processing Group

The Tadala group is located in Manguluni, Phalombe District. The group is the youngest and largest group. It was established in August 2011 and has 18 members. Personal interviews were held with six of the group members and 12 women were present during the FDG. The group had two solar driers, but did not have access to a new smoking kiln.

Presenting the WFPG Members

Table 2.3 gives an overview of the women that participated in the personal interviews. The table will be useful throughout the thesis as the respondent codes will be used to identify the women. The table indicates that the women are between 22 and 42 years old. Only ten out of eighteen women are married and the majority have more than four children. Their education level is low as only one woman has been enrolled in secondary education.

Table 2.3: Demographics of WFPG members

Respondent	Age	Marital status	Head of Household	Dependants	Education	Literacy
K1	35	Married	Male	4-6	Primary 1-5	Yes
K2	34	Married	Male	4-6	Primary 1-5	No
K3	42	Married	Male	7-9	None	No
K4	N/A	Separated	Female	4-6	Primary 1-5	No
K5	31	Married	Male	4-6	Secondary 1-2	Yes
K6	43	Widowed	Female	4-6	Primary 6-8	Yes
S7	37	Married	Male	4-6	Primary 1-5	Yes
S8	27	Married	Male	7-9	Primary 6-8	Yes
S9	30	Married	Male	7-9	Primary 1-5	Yes
S10	40	Married	Male	10-12	Primary 1-5	Yes
S11	25	Widowed	Female	7-9	Primary 1-5	Yes
S12	40	Married	Male	7-9	Primary 6-8	Yes
T13	25	Divorced	Female	4-6	Primary 6-8	Yes
T14	31	Married	Male	7-9	Primary 1-5	No
T15	32	Widowed	Female	7-9	Primary 1-5	Yes
T16	23	Separated	Female	4-6	Primary 1-5	Yes
T17	22	Widowed	Female	1-3	Primary 1-5	No
T18	37	Separated	Female	1-3	Primary 1-5	Yes

K = Kachulu Women Fish Processing Group, S = Swang'oma Fish Processing Group and T = Tadala Fish Processing Group.

Chapter Three: Literature Review and Theoretical Framework

The following chapter will provide a literary foundation and present concepts and theories that will form the theoretical framework for the thesis. The chapter is split up in two sections: The first section focuses climate change adaptation, vulnerability and adaptive capacity, three concepts that are interlinked in the climate change discourse, followed by a presentation of the conceptual framework for assessing adaptive capacity used in chapter six. It gives insight into the concepts, clarifies how the study intends to utilise them and illustrates the relevance of the concept for the thesis. Part two introduces the concept of local knowledge and gives a historical background of the concept that places in with the development discourse. The last section critically elaborates on the use of local knowledge in climate change adaptation, which creates a theoretical background for the analysis in chapter seven.

Part One: Linking Adaptation, Vulnerability and Adaptive Capacity

Climate Change Adaptation

In the 1990s and early 2000s the climate change debate was mostly focused on how to mitigate climate change. In recent years growing attention has been given to adaptation to climate change at both local to global level (Adger et al. 2009:336). At the thirteenth Conference of Parties (COP 13) of the United Nations Framework Convention on Climate Change in Bali 2007, adaptation was acknowledged as one of the four 'building blocks' required to respond to climate change alongside mitigation, technology cooperation and finance (Dodman and Mitlin 2011:2). At the sixteenth Conference of Parties (COP 16) in Cancun, Mexico, parties adopted the Cancun Adaptation Framework (CAF), which affirms that adaptation must be addressed at the same level as mitigation. The framework illustrates the urgency and international commitment to prioritise adaptation and states that

> Enhanced action and international cooperation on adaptation is urgently required to enable and support the implementation of adaptation actions aimed at reducing vulnerability and building resilience in developing country Parties, taking into account the urgent and immediate needs of those developing countries that are particularly vulnerable (UNFCCC 2011:4).

The literature provides a broad spectrum of understandings of the concept, but for this study the understanding of adaption will specifically be related to climate change. Adger et al. (2003:192) provides a useful definition and refers to adaptation to climate change as "the

adjustment of a system to moderate the impacts of climate change, to take advantage of new opportunities or to cope with the consequences".

Adaptation rarely only focuses on factors related to climate change, but incorporates other elements that constitute a threat to the communities that may aggravate through climate change, such as poverty. Adaptation initiatives may be carried out by the government, NGOs, CBOs or individuals and may be either anticipatory or a reactive action. The result of adaptation is reduced vulnerability or increased resilience and it involves changing processes or practices in social and ecological systems through reducing potential damages or engages in new opportunities (Adger et al. 2007:720). However, there is no final destination of adaptation. Because the environmental and social systems are constantly changing, adaptation is an on-going dynamic process that societies constantly go through.

The IPCCs Fourth Assessment Report states that Africa especially needs to invest in adaptive capacity to climate variability and climate change in the long term as Africa is especially vulnerable to climate change and the situation is intensified by extensive development challenges (Boko et al. 2007:454). Climate change is known to bring future stress into the continents food security, eco-systems, human health and increase water stress throughout Africa (Boko et al. 2007:435). The agriculture sector is particularly threatened by climate variability and climate change, which increases the continents economic vulnerability as there is a heavy reliance on agriculture in both local livelihoods and national GDP (Boko et al. 2007:439). Key adaptation strategies that are recognised as beneficial for Africa are diversification of livelihood activities, adjustment in farming operations, income generating projects and selling of labour and the move towards off-farm or non-farm livelihood incomes (Boko et al. 2007:452). These adaptation strategies are considered to be relevant also to Malawi.

Adaptation in Malawi

Despite Malawi's low contribution to the anthropogenic climate change, the country is highly vulnerable to irregularities in the climate as their economy and rural livelihoods heavily depend on natural resources (EAD 2006:2). Chapter two outlines how Malawi has been affected by climate change and the predicted scenarios for the future. It is the changes in seasonality and extreme weather events that have been the most evident changes (Boko et al. 2007:436). The Government of Malawi has identified climate change as one its priority areas

in the Malawi Growth and Development Strategy (MoDPC 2009). The focus areas correspond to the issues identified in Malawi's National Adaptation Programmes of Action (NAPA). The United Nations Framework Convention on Climate Change (UNFCCC) encourages all the LDCs to develop NAPA documents "to identify priority activities that respond to their urgent and immediate needs to adapt to climate change – those for which further delay would increase vulnerability and/or costs at a later stage" (UNFCCC 2012). Malawi published their NAPA in 2006 which lists 15 priority adaptation options. The most urgent adaptation interventions were grouped into adaptation strategies and recommendations were made to implement equivalent strategies immediately. The adaptation strategies that were identified were,

a) Improving community resilience to climate change through the development of sustainable rural livelihoods,
b) Restoring forests in the Upper and Lower Shire Valleys catchments to reduce siltation and associated water flow problems,
c) Improving agricultural production under erratic rains and changing climatic conditions,
d) Improving Malawi's preparedness to cope with droughts and floods, and
e) Improving climate monitoring to enhance Malawi's early warning capability and decision making and sustainable utilisation of Lake Malawi and lakeshore areas resources. (EAD 2006:xii)

The Lake Chilwa Climate Change Adaptation Programme aim is to support the urgent adaptation needs identified in NAPA (LEAD et al. 2009:2) which has components from all of the adaptation strategies listed above. The Women Fish Processing Groups falls within the first point as it aims to improve the women's adaptive capacity through improved methods of fish processing, based on local participation and adaptation. The LCBCCAP is also in line with CAF guidelines as it emphasises the importance of adaptation strategies being participatory, gender-sensitive and based on the best available science and appropriate indigenous knowledge (UNFCCC 2011:4).

Adaptation is closely linked with other concepts that are central in the climate change discourse, the concepts of adaptive capacity and vulnerability. Adaptation can be seen as an indication of adaptive capacity that represents different ways of reducing vulnerability towards climate change (Smit and Wandel 2006:286). Vulnerability and adaptive capacity are therefore also closely linked. Increasing a system's adaptive capacity will directly reduce its vulnerability as the positive forces reduce the system's weaknesses or deficiencies. Vice versa, assessing vulnerability can in turn be used to identify a systems adaptive capacity or

how to improve it. An elaboration of the two concepts will be presented below and placed within the context of the thesis.

Vulnerability to Climate Change

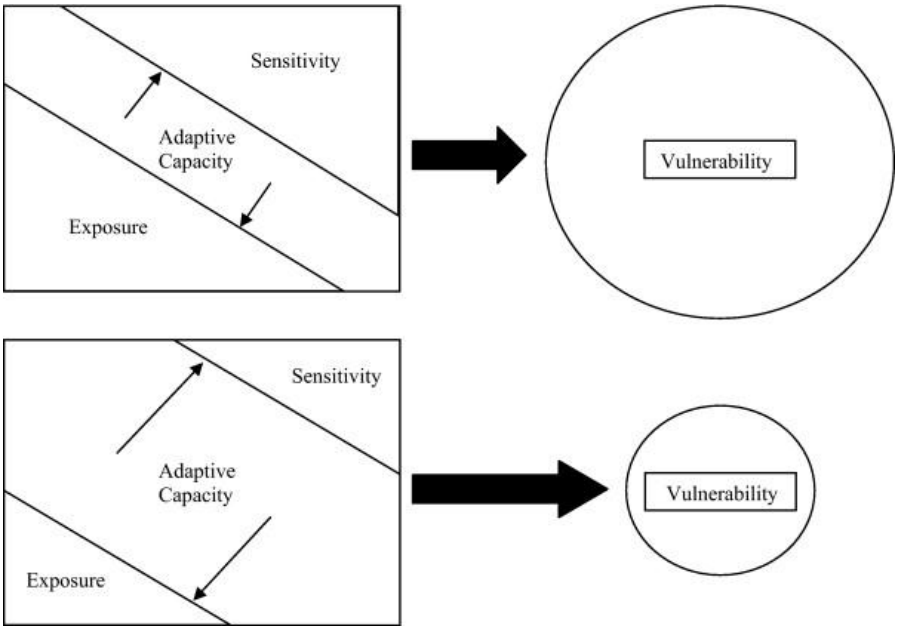
The vulnerability of any system can be understood as being "reflective of (or a function of) the exposure and sensitivity of that system to hazardous conditions and the ability or capacity or resilience of that system to cope, adapt or recover from the effects of those conditions" (Smit and Wandel 2006:286). Some scholars have however noted that when it comes to the climate change discourse the concept of vulnerability has been used in two distinct ways (Kelly and Adger 2000, O'Brien et al. 2004). Kelly and Adger (2000) have differentiated between the two understandings by calling them the end point and start point interpretation of vulnerability. By viewing vulnerability as an end point vulnerability is understood as the net impact of climate change. Kelly and Adger (2000:327) refer to it as "the sequence of analyses beginning with projections of future emission trends, moving on to the development of climate scenarios, thence to biophysical impact studies and the identification of adaptive options". Vulnerability then represents the remaining consequences after adaptation has been implemented. International Panel on Climate Change (IPCC) uses the end point interpretation when assessing vulnerability. It serves the purpose well as IPCC is interested in calculating the net impact of climate change which can be done quantitatively through monetary cost, human mortality, ecosystem damage or qualitatively as a description of relative or comparative change (O'Brien et al. 2004:2).

However, the end point interpretation of vulnerability does not address socio-economic, social or political causes of what makes a community or a person vulnerable to climate change. Vulnerability, understood from the start point interpretation also focuses on these characteristics when assessing vulnerability, and here vulnerability is considered "a characteristic of social and ecological systems that is generated by multiple factors and processes" (O'Brien et al. 2004:2). The purpose of assessing vulnerability in these two interpretations is then to understand the existing constrains that limits the capacity to respond to hazards. This interpretation presents a valuable alternative in order to assess the social consequences of climate change and to identify why some people will be more or less affected than others. This will in turn give valuable insight for policy makers and development agencies seeking to reduce people's vulnerability to climate change (Kelly and Adger 2000:329, O'Brien et al. 2004:12). For the majority of social research it is the later

interpretation of vulnerability that is of interest and it is within this interpretation of the concept that vulnerability will be discussed in this paper.

The next section will introduce the concept of adaptive capacity, however the link between the two concepts is explained first. Adaptive capacity is a central concept in the climate change discourse and refers to "the ability or potential of a system to respond successfully to climate variability and change" (Adger et al. 2007:727). In other words, a higher adaptive capacity increases the likelihood of adapting successfully to climate change. The concept is similar to other used concepts in the climate change discourse, including adaptability, coping ability, management capacity, stability, robustness, flexibility and resilience (Smit and Wandel 2006:286). Vulnerability and adaptive capacity are closely linked in the climate change discourse. Increasing a system's adaptive capacity will directly reduce its vulnerability as the positive forces reduce the systems weaknesses or deficiencies. Vice versa, assessing vulnerability can in turn be used to identify a systems adaptive capacity or how to improve it. This relationship between vulnerability and adaptive capacity is seen in figure 3.1

Figure 3.1: Adaptive capacities role in influencing vulnerability



Source: Engle (2011)

Adaptive Capacity

The adaptive capacity depends on the existing resources in the system at that time and the capacity to utilise the resources when needed. It is therefore context specific and dynamic as it is highly influenced by economic, social, environmental and political changes. These changes

can range from local to international and they may be slow or sudden in time (Smit and Wandel 2006:287). Adaptive capacity does not naturally quantify, but it is possible to create a comprehensive picture of a system's adaptive capacity by assessing the available resources or determinants. What determinants to focus on, has varied between scholars as well as development agencies. Until recently, financial capital and technology was seen as the most important determinants of adaptive capacity, but recent studies have argued for the importance of also addressing socio-economic, political and social components (Smit and Wandel 2006:287, Nyong et al. 2007:792). The argument is that adaptive capacity of a community or an individual is not merely influenced by the financial or technical resources available. How a system is able to deal with changes, either to a current hazard or to future events, is also highly dependent on other factors such as governmental policies, availability of institutions, property rights, education and social factors such as social capital, social networks, values, perceptions, customs and traditions (O´Brien et al. 2004, Adger et al. 2007). Including a wide variety of determinants will give a more holistic and realistic understanding of a system's adaptive capacity. The value of a determinant may however differ between contexts. As noted by Smit and Wandel (2006:288) the determinants of adaptive capacity do not necessarily have the same value in all countries, communities, social groups or for each individual. For example, Adger (2003:388) argues that the adaptive capacity of a group is somewhat determined by their ability to act collectively, on their networks and social capital. This is especially true in developing countries where poor people lack financial capital and access to social services which are important factors to reduce stress, but it may not be as important in a developed country.

Further, Adger et al. (2003:179) argue that "all societies are fundamentally adaptive…but some sectors are more sensitive and some groups in society more vulnerable to the risks posed by climate change than others". There is a consensus amongst policy makers and researchers that the more socially and economically marginalised people are, the more vulnerable they will be to the effects of climate change (MacGregor 2010:130). Rural women from developing countries, who constitute a great proportion of the world's most disadvantaged, are therefore regarded as especially vulnerable. This is in line with Nelson and Stathers (2009:81) argument as they claim that it is very likely that climate change will be experienced differently by men and women. IPCC's Fourth Assessment Report recognises that the ability to adapt is uneven across and within societies and state that women in subsistence farming communities are especially vulnerable to the consequences of climate

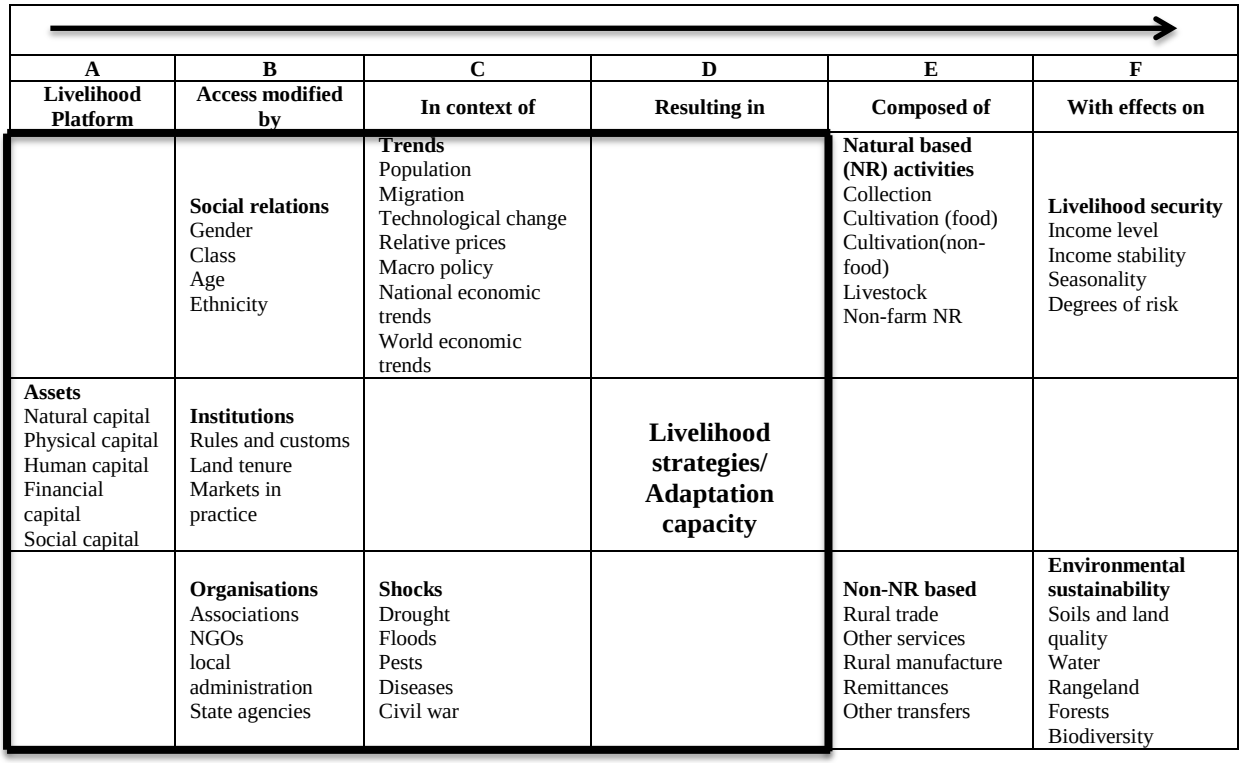
change and disproportionately burdened with the cost of recovery (Agder et al. 2007:719). These statements clearly indicate that climate change is a topic that is gender-sensitive. Arora-Jonsson (2011:748) however argues that is important not to label women as vulnerable without having sufficient understanding of the context. Women are not a homogenous group and gender-roles, power relations and the women's reliance on natural resources versus non-natural resources are factors that will influence how vulnerable women are. She further claims that specific case studies are needed in order to understand the link between gender and climate change (Arora-Jonsson 2011:749). This study will assess the WFPG member's adaptive capacity, which will reveal factors that are important to understand the women's' level of vulnerability. It must however be noted that the study is not a gender study per say as it lacks data and elements that are important in such a study. In spite of that, the study will still be important for gender and climate change studies as it will reveal certain elements of issues the women are dealing with in relation to climate change. The next section will present the contextual framework that will be used when assessing the WFPG members' adaptive capacity.

Conceptual Framework for Assessing Adaptive Capacity

The need to assess or understand adaptive capacity has increased as it has become evident that mitigation is not sufficient to deal with climate change. Researchers as well as institution are working towards finding appropriate ways of assessing and measuring adaptive capacity at local and national level. Brooks et al. (2005) identified 46 indicators of vulnerability and capacity to adapt to climate variability focusing on economic well-being and inequality, health and nutritional status, education, physical infrastructure, governance, geographic and demographic factors, agriculture, ecosystems and technological capacity. While the indicators are also relevant at the individual and local level, the study intended to identify indicators that can be quantified and that are crucial when assessing the vulnerability and adaptive capacity of countries. In "Adaptive capacity and its assessment" Engle (2011) draws on insight from vulnerability and resilience framework to identify measurements and characteristics of adaptive capacity. While managing to present the concepts of vulnerability and resilience and how they are linked to adaptive capacity, Engle (2011) does not provide a finalised framework that can be used to assess adaptive capacity as he claims that more empirical examples of assessments that draw from both vulnerability and resilience frameworks (Engle 2011:645) . Dukal et al. (2010) conducted a study in Nepal focusing on if the poor's ability to adapt. In

order to draw a conclusion the study focused on five components: human, natural, physical, social and financial capital. This is similar to Nelson et al. (2009a) study of assessing the adaptive capacity and vulnerability of Australian rural communities to climate variability. In their study they combine hazard/impact modelling with a holistic adaptive capacity approach drawing on Ellis (2000) rural livelihoods framework.[7] Simplified, figure 3.2 illustrates the components or assets influencing rural livelihood strategies and how these affect livelihood security and environmental sustainability.

Figure 3.2: A framework for analysing rural livelihoods/adaptive capacity



A	B	C	D	E	F
Livelihood Platform	**Access modified by**	**In context of**	**Resulting in**	**Composed of**	**With effects on**
	Social relations Gender Class Age Ethnicity	**Trends** Population Migration Technological change Relative prices Macro policy National economic trends World economic trends		**Natural based (NR) activities** Collection Cultivation (food) Cultivation(non-food) Livestock Non-farm NR	**Livelihood security** Income level Income stability Seasonality Degrees of risk
Assets Natural capital Physical capital Human capital Financial capital Social capital	**Institutions** Rules and customs Land tenure Markets in practice		**Livelihood strategies/ Adaptation capacity**		
	Organisations Associations NGOs local administration State agencies	**Shocks** Drought Floods Pests Diseases Civil war		**Non-NR based** Rural trade Other services Rural manufacture Remittances Other transfers	**Environmental sustainability** Soils and land quality Water Rangeland Forests Biodiversity

Source: (adapted from Ellis 2000:30)

The same framework can be used when assessing adaptive capacity to natural hazards or climate change as it is the same assets that influence an individual's or a community's ability to deal with stress (Ellis 2000:45, Nelson et al. 2009b:4). The highlighted box in figure 3.1 is the part of the livelihood framework that is relevant for analysing adaptive capacity.

[7] A livelihood compromises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediates by institutions and social relations) that together determine the living gained by the individual or household (Ellis 2000:10)

Nelson's et al. (2009a) framework conceptualises adaptive capacity as an "emergent property of the diverse forms of human, social, natural, physical and financial capital from which rural livelihoods are derived, and the flexibility to substitute between them in response to external pressure" (Nelson 2009a:20). There is a correlation between the amount and diversity of assets and adaptive capacity due to the possibility to substitute between alternative livelihood strategies. In other words, greater diversity of assets equals greater adaptive capacity (Nelson 2009a, Ellis 2000).

This study will utilise the conceptual framework of Nelson et al (2009a) when assessing the adaptive capacity of the WFPG members and how LCBCCAP may have enhanced it as it will ensure a holistic assessment. I argue that by doing this I will detect their available assets, which will allow me to develop a picture of the women's adaptive capacity and further their vulnerability towards climate change. LCBCCAP Livelihood Analysis Report (Nagoli 2010) includes an assessment of the basin's livelihood. This report will be of value when assessing the WFPG member's adaptive capacity as it provides an understanding of what is common, in relation to human, social, natural, financial and physical capital in the basin.

Table 3.1 defines the assets that will be used to analyse the WFPG adaptive capacity. Due to the complexity of 'social capital' and importance of it for rural poor, a short elaboration of the term and presentation of key concepts related to social capital will be presented below.

Table 3.1: The capitals or assets from which rural livelihoods are derived

Capital	Description
Human	Refers to the labour available to the household: its education, skills and health.
Social	Reciprocal claims on others by virtue of social relationships, the close social bonds that facilitate cooperative action, and the social bridging and linking via which ideas and resources are accessed.
Natural	Comprises the land, water and biological resources that are utilised by people to generate means of survival.
Physical	Comprises capital that is created by economic production processes such as buildings, irrigation, roads, tools, machines.
Financial	The stocks of financial resources to which households have access to, including cash, incomes, access to other financial resources (credit and savings) and overall wealth that influences the ability to generate income.

Source: modified from Ellis (2000:32-36) and Nelson (2009b:3).

Social capital

In "Social Capital, Collective Action, and Adaptation to Climate Change" Adger (2003) argues that adaptation is a social process and an individuals or a community's ability to adapt is therefore partially determined by its ability to act collectively. In order for a community to

act collectively certain elements are required. In social sciences these elements are gathered under the concept of social capital. Further, Adger (2003:389) claims that social capital is especially important for resource-dependent communities, as they are particularly vulnerable to changes in the climate. Social capital then becomes an important factor to increase adaptive capacity as social capital will allow the community to collectively find solutions to current or future problems, but it also functions as a safety net as relationships of trust and reciprocity will help individuals to cope during difficult times. From these arguments it is evident that social capital may indeed be an important asset for the WFPG members when dealing with climatic changes.

Since the 1990s social capital has gained a dominant position within social sciences and development theory. The basic idea of social capital is that the people you know constitute an important asset. Friends, family and associates can be of great assistance during a crisis or to simply 'get ahead'. Woodlock and Narayan (2000:225) illustratively summarise social capital with the phrase "it's not what you know, it's *who* you know". This is because social networks and relationships determine to a large extent whether or not individuals or groups have access to or control important resources.

Bonding and *bridging* are central concepts in social capital and help describe interpersonal relationships of trust and reciprocity. Bonding social capital, often understood as 'thick' ties, are found between individuals sharing similar identities (i.e. ethnicity, religion, and locality). Bridging ties explain horizontal relationships between people of contrasting social identity, but who share the same interests or goals. In other words it describes ties that are more distant. Bridging ties also has a subcategory known as linking which refers to vertical relationships where status, authority and power relations usually are asymmetrically (i.e. between groups, social classes, organisations and institutions) (Woodlock and Narayan 2000:227, Pelling and High 2005:310, Prakash and Selle 2005).

The term social capital is interpreted in different ways and scientists emphasise different factors. Pelling and High (2005:313) therefore state that individual studies will have to choose the analytical categories they see fit. Adger (2003:392) presents two concepts of social capital that builds on bonding and bridging but that differentiates between private and public faces of social capital that he calls *bonding social capital* and *networking social capital*. These are the terms that will be used in this thesis due to their relevance to climate change adaptation. Bonding social capital refers to sharing of knowledge, the sharing of financial risk, the sharing of market information, or claims of reciprocity in times of crises. These are ties within

a defined socio-economic group and are usually based on family kinship and locality. Networking social capital is based on weaker bonds of trust and reciprocity and while bonding social capital relies on norms and values linked to a group, networking social capital relies on legal and formal institutions, such as the government, institutions and organisations. Bonding social capital is therefore typically horizontal bonds, while networking social capital refers to vertical bonds.

Part Two: Utilising Local Knowledge

Historical Background of Local Knowledge

The concept of local knowledge in development can be traced back to the post-World War II development era where 'modernisation' was seen as the solution to underdevelopment. Technology and Western knowledge was seen as a cure to poverty while indigenous knowledge was seen as the cause or the main obstacle for development. The local population was manipulated into believing that they were incapable of dealing with their own problems and needed assistance from external experts to help identify and treat the problems (Rahnema 1990:200, Smit 2011:596).

However in the 1970s it became evident that the strategies of 'modernisation' often had generated irrelevant and inappropriate results for the rural poor and consequently had failed to eradicate poverty. At the same time that McNamara, former president of the World Bank, announced in 1973 that "Growth is not equitably reaching the poor" (in Rahnema 1990:201), new alternative approaches emerged as a response to the 'top-down' approaches. The new 'bottom-up' approaches emphasised the importance of including the neglected local population in project planning. 'Participatory development' and the alternative research model 'Rapid Rural Appraisal' (RRA) developed by Robert Chambers, that emphasise accessing indigenous technical knowledge to enhance local development, were central in developing the new direction within development. RRA was soon joined by Participatory Rural Appraisal (PRA), which seeks to work with local people in a more participatory way through research. According to Chamber (1994:958) the main difference is that an RRA is intended for learning by outsiders and the PRA is intended to enable local people to conduct their own analysis, and often to plan and take action".

While participatory development was a result of failed top-down approaches, local knowledge in development has its origins from anthropology (Sillitoe 2006:2). Through local knowledge anthropologists seeks to understand the locals way of life. Local knowledge in development however seeks to contribute towards changing their way of life to something better by working together with the communities to identify their capabilities and preferred needs (Smit 2011:596). Participatory development and the research methods that go with it are therefore very much linked to the concept of local knowledge as both emphasise the need to include local people and prioritises their knowledge in order to develop sustainable projects (Smit 2011:597).

Local Knowledge and Development

Today local knowledge has an important role in development theory and it is utilised by a wide range of agencies, policy makers and organisations. Local knowledge is proclaimed to be a solution to the endless numbers of failed development projects and Brokensha et al. (in Agrawel 1995:7) argues that "to ignore people's knowledge is almost to ensure failure in development". Local knowledge has become accepted as an important component in the design and implementation of sustainable development projects. Projects that are rich in local content are said to be both sustainable and effective as local people have valuable knowledge about their communities and their natural surroundings. This is especially an important argument for encouraging local participation in climate change adaptation projects as local people are the ones with best insight into the local climate and previous events of natural hazards (Nyong et al. 2007:787-788). This knowledge can be of great importance to plan for future events. In addition, it is the local people that best know their weaknesses and their needs. By including the beneficiaries in project design and implementation, the chances are the projects will be better equipped to answer to their specific situation. Box 3.1 provides a list of arguments for incorporating local knowledge in development, presented by Sillitoe (2006:6).

Box 3.2: Benefits of utilising local knowledge

- Local knowledge enriches understanding of development opportunities within a cultural context, promoting culturally appropriate interventions relevant to people´s needs
    - Appreciation of local ideas and practices encourages more sustainable development interventions
    - Local knowledge helps avoid expensive mistakes by preventing research and development initiatives that start from false premises through failing to show respect for local views.
- Local knowledge facilitates communication across the interface between development project and local community, raising awareness of scope of research and possible development alternatives
    - Discourages imposition of foreign ideas
    - It helps reconcile different and potentially conflicting cultural perspectives regarding development initiatives by promoting awareness of others' views.
- Local knowledge realises the comparative advantage of both insider and outsider knowledge, creating opportunities for synergy
- Local knowledge furthers empowerment of the poor through respect for their knowledge and management practices
    - It promotes more effective local participation in planning, decision-making and implementation
    - It may advance scientific understandings, as it may reveal intelligence unknown to science
- Local knowledge increases awareness about local issues

Source: Sillitoe (2006:6)

A very essential argument for utilising local knowledge, which is also listed by Sillitoe (2006:6), is presented by Nyong et al. (2007). They argue that "building on the indigenous

knowledge system of the region offers great prospects for effective integration of mitigation and adaptation strategies that will be attractive to the vast majority of small-scale farmers who are expected to use them" (Nyong et al. 2007:792). In other words, if the local people are familiar with the practices/products/etc. that is introduced, there is a greater chance that they will utilise it and hence increase the chance of success.

Research as well as development agencies have focused on different ways in which local knowledge is utilised. In the early stages of incorporating the concept of local knowledge in development, local knowledge was often understood as a technical solution and as a set of assets that could be extracted from a community to be applied elsewhere (Briggs 2005:101).One of the more common ways of utilising local knowledge in the recent years is similar to participatory approaches. Participation is about accessing and using the local knowledge in order to make the development projects appropriate and effective (Smith 2011:597). However, local knowledge is more than a tool for the development agencies. When talking about utilising local knowledge through participatory means, there should also be a focus on the benefits for the local people. According to Smith (2011:597), utilising local knowledge through participatory means may also empower the local people if they are involved at all stages of project. It should not only be about applying or extracting knowledge, but about generating knowledge locally.

Local knowledge is more than just what local people know. It is about their knowledge, but it is also about their practices, their priorities, their beliefs and so on. It is about everything they bring into a discussion concerning development because local knowledge is about involving the local population in decision-making, project design, implementation, evaluation and monitoring. This is why a wide definition of local knowledge is necessary. This thesis will adopt the definition used by United Nations Educational, Scientific and Cultural Organization (UNESCO), which states that local knowledge, also known as indigenous or traditional knowledge, can be understood as "the cumulative and complex bodies of knowledge, know-how, practices and representations that are maintained and developed by peoples with extended histories of interactions with the natural environment" (UNESCO 2003).

A Critical Approach to Local Knowledge

However, in recent years several scholars have started questioning the romanticising of local knowledge. Especially previous, but also recent research paints a picture of local people as a-

historic and unchanging, isolated from the 'outside' and living in harmony with nature in a sustainable manner (Smith 2011:698). Local knowledge is then understood as fundamentally 'good' and 'useful'. Romanticising local knowledge may obscure the reality of local communities as local knowledge is not guaranteed to be either 'good' or 'useful'. As noted by Chambers (in Smith 2011:599) "in some cases, local knowledge and practices may be restrictive, conservative, lined with misconceptions and prejudices, or may reflect a lack of local capacity to deal with a particular issue". A study done by Klooser (2002) on forest resources illustrates this matter as he found that natural resources are not always used sustainably. Cleaver (1999 in Briggs 2005:108) rightly asks "whether there is not a danger of swinging from one untenable position ("we know best") to and equally untenable and damaging one ("they know best")". Further, local knowledge is often thought of as a unitary knowledge, as though the knowledge is shared equally across the community. This perception is far from true and Briggs (2005:105) explain that the knowledge and level of knowledge is determined by factors such as age, experience, wealth, product priorities, household circumstances, political power and gender. Such factors influence access and the ability to use such knowledge in communities.

Briggs (2005:111) also provides a relevant critique of using local knowledge in development. He does not argue that it is irrelevant but says that it is problematic to conceptualise local knowledge and notes that it should be viewed as "something more nuanced, pragmatic and flexible, perhaps even provisional, highly negotiable and dynamic. His argument is important as it recognises that local knowledge is not static, neither is in necessarily pure 'local' as most societies are influenced by other knowledge systems. Local knowledge cannot be viewed as an entity, a package of knowledge from one location. As noted by Smith (2011:599), "in reality local communities are often far from consensual and homogeneous and therefore do not produce a uniform 'knowledge'". The question of power relations within a community must therefore also be considered. A relevant question must therefore be, *within* a community, *whose* knowledge should be utilised (Briggs and Sharp 2004:666, Briggs 2005:105, Smith 2011:605). Silva and Kepe (2010) raise the question of *whom* in participation. In their case study of a community development project in Tanzania, they found that the poor were excluded from the project because they were too poor to participate due to time and labour constrains (Silva and Kepe 2010:52). Projects that utilise participatory approaches and local knowledge must be aware of such cases in order to facilitate for the poorest of the poorest to participate. The list of questions to ask does, however, not end here. Rambali et al. (2006:108)

provide a list of 46 *Who?* and *whose?* questions that should be kept in mind throughout a participatory process. These include 'Who decides on who should participate? Whose reality? And who understands? Who benefits from the changes? At whose costs? Who gains and who loses? Who is empowered and who is disempowered?'

Scholars have for a long time debated the issue of scientific/modern/western knowledge and local knowledge. If local knowledge is to be implemented into development, what role should it play, how is it actually done, what if it is not sustainable and can it compete with scientific knowledge? Several scholars have raised the problematic that western knowledge is continually regarded as the superior knowledge system (Rahnema 1990, Chamber 1994, Briggs and Sharp 2004, Briggs 2005, Sillitoe 2006, Nyong et al. 2007, Smith 2011). What is the purpose of utilising local knowledge if it is always regarded as a supplement to scientific knowledge? Briggs and Sharp (2004:667) state that "indigenous knowledge is not being allowed to offer a fundamental challenge to development, just the opportunity to offer a few technical solutions, place-specific tweakings". Their statement is a response to the World Banks (1998) report "Indigenous knowledge for development: a framework for development". The World Bank presents indigenous knowledge as a technical tool and emphasises that all indigenous knowledge needs to be validated and evaluated. It is therefore the scientific view that will decide whether or not the indigenous knowledge is of value to development. Briggs and Sharp (2004:668) stresses the importance of "western science as a knowledge must be open to changes, however difficult this may me".

Briggs (2005:110) argues that one must recognise that there are limits to what local people know, as well as there are limits to what external networks know about the local conditions. Local knowledge is usually not the sole answer to local development, but if local communities and external networks work together they can learn from each other and develop sustainable outcomes. This is in line with Bebbington (2002:514) who argues that "almost everything in development is coproduced". By this he means that that the outcome of development projects or states interventions is a hybrid of both local and external measures and interest. This is because people encounter development from their own daily concerns to improve their conditions. From a study from Ecuador Bebbington (2005:513) found that "modernizing development is...often taken, transformed, and used; and similarly, modernizing institutions are worked with, used, transformed, and tuned, as far as possible, to people's own purpose". Bebbington's argument is relevant to the local knowledge discourse as scholars argue for the importance of merging local and scientific knowledge. Nyong et al. (2007:795)

argue that development agencies should utilise the scientific evidence that is available and combine in with local knowledge in order to produce "best practices". The later argument is especially interested as LCBCCAP claim that they combine scientific and local knowledge. It is important to recognise that local knowledge is not the solution in itself. Local knowledge and participation is not a panacea to development, but a useful tool when used in collaboration with other knowledge systems and approaches.

An issue that has been raised about utilising local knowledge in development concerns generalisation. Development agencies are interested in tools that can be used to fight poverty, hunger, illiteracy etc. Local knowledge has been described as such a tool. However, in order for local knowledge to be incorporated into development and now climate change adaptation, it's necessary to develop standard approaches based on reliable generalisations. However, Sillitoe (2006:8) argue that local knowledge cannot be generalised as it is rooted in each specific location. It is important to acknowledge that local knowledge is not a set package of knowledge. As stated by Sillitoe (2006:8) "knowledge is diffuse and communicated piecemeal in everyday life. It is not homogenous; there is often no consensus among the 'natives'. People transfer much through practical experiences, and are unfamiliar with expressing all that they know in words". The main difference between 'local knowledge' and western scientific knowledge is that local knowledge is contextualised – it is deeply embedded within its social, cultural, political and economic context. Western scientific knowledge "thrives on abstract formulation and separation from the lives of the investigated" (Briggs 2005:109). The question then is why do development agencies, such as the World Bank, try to use local knowledge the same way as a completely different knowledge system? According to Briggs (2005)

> It is precisely the local embeddedness of indigenous knowledge that imbues it with relevance, applicability and even power. There are, therefore, the real danger that indigenous knowledge will lose its agency and efficacy if it becomes depersonalized and/or objectified, and is used in some sort of top-down manner. There are, therefore, real problems in applying indigenous knowledge ideas out of context" (Briggs 2005:109).

Briggs (2005) statement illustrates that it is not the general local knowledge that should be utilised as a tool, it is the practice of utilising it that must be generalised. The LCBCCAP serves as a good case to discuss how it can be done for climate change adaptation. The next section will address climate change and local knowledge more specifically and shed light on relevant studies on the topic.

Climate Change Adaptation and Local Knowledge

In the dominant discourse of adaptation in international negotiations, adaption is viewed as something that the international development agencies will conduct. Adger et al. (2003:192) however notes that there is a serious limit to what international agencies can achieve and that much of the adaption will rely on previous experiences and will be performed by local communities with their own social capital and resources. As local communities have experience with adapting to climatic changes, adaptation programmes conducted by national or international development agencies, such as Lake Chilwa Basin Climate Change Adaptation Programme (LCBCCAP), have potentially a lot to learn from local communities.

While there is much research on the concept of climate change adaption there is less about local knowledge in relation to climate change adaptation as this is a fairly new field. However, in recent years some studies have been conducted that have focused on this specific topic and that argue for the importance of incorporating local knowledge into adaption strategies.

In "Value of indigenous knowledge in climate change mitigation and adaptation strategies in Africa" Nyong et al. (2007) presents a case from the African Sahel where communities have adapted to increasing numbers of severe droughts by using their indigenous knowledge system. These are strategies such as agro-forestry, which is an effective carbon sequestration method as well as a practice that is favourable for shade tolerant crops. When planning agro-forestry projects local knowledge can be crucial for success. The knowledge about the importance of the baobab and acacia trees during dry seasons goes back in time for the people of the Sahel. Researchers have however only recently realised their potential (Nyong et al. 2007:793). Nyong et al. (2007:787) therefore argue for the importance of recognising local adaptation strategies and for these to be considered in design of adaption strategies.

Blanco argues along the same lines when (2006:145) emphasising the need to incorporate local experiences with climate change in project design and implementation. It is further argued that it is necessary to close the gap between community-based organisations (CBO) and the scientific community in order to bring relevant information closer to the communities as well as bringing the valuable information from the communities to the policymakers and development planners. Without linking local experienced and academic knowledge, Blanco (2006:145) claims that adaptation projects will not be able to successfully respond to the challenges posed by climate change.

Blanco (2006) and Nyong et al. (2007) arguments are therefore in line with Bebbington's (2000) reflection presented above about the need for a two-way communication between local communities and external agencies. Both emphasise the importance of local people participating in project design and implementation, not for development agencies or policy makers to simply extract local knowledge from a community (Blanco 2006:145, Nyong et al. 2007:795). This echoes the issue of how local knowledge can or should be utilised in development, and now climate change adaptation. It can therefore be argued that when it comes to utilising local knowledge for climate change adaptation, it has as much to do with encouraging local participation as it does incorporating their knowledge into project design.

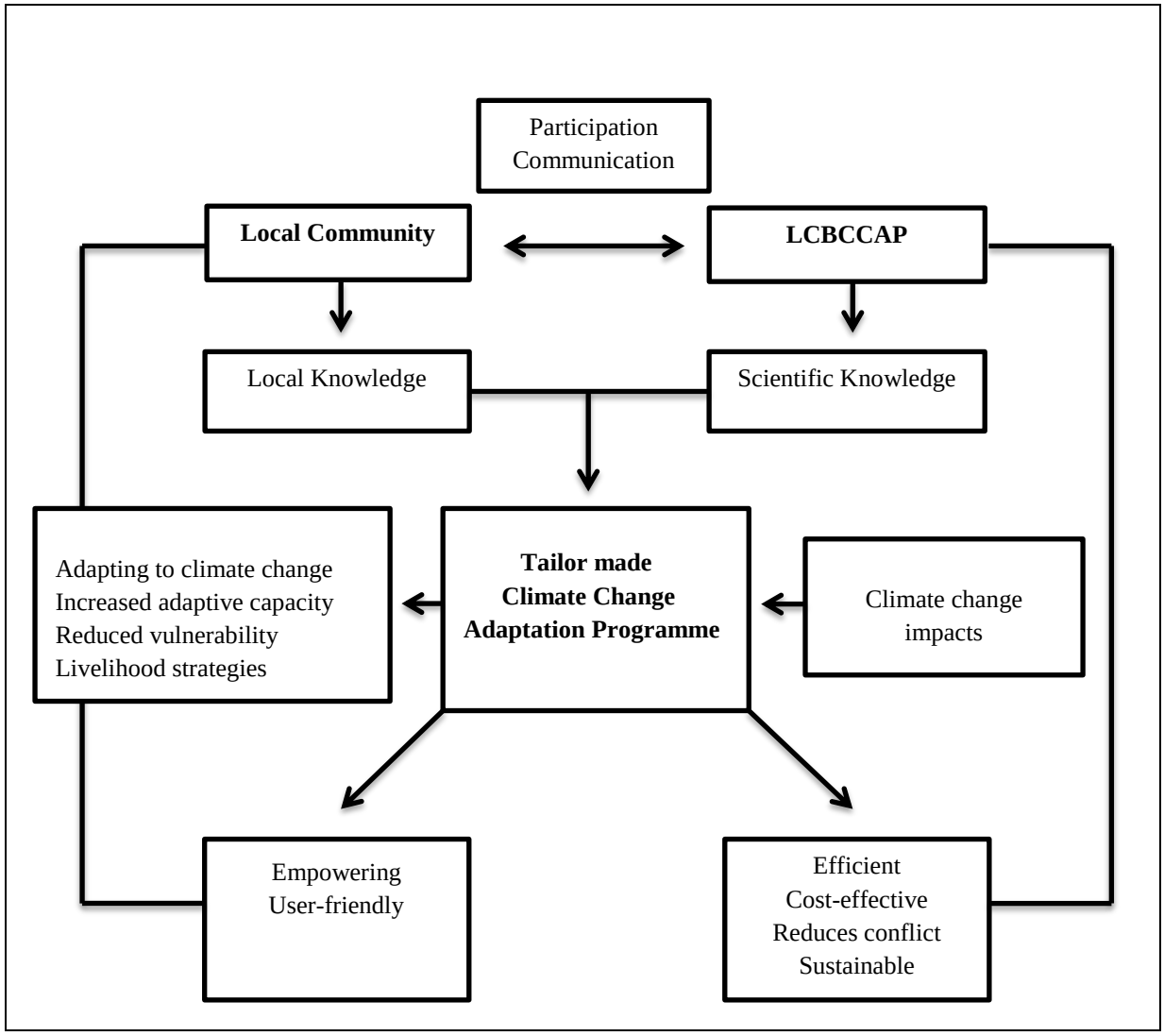
Dodman and Mitlin (2001) look at a similar concept closely related to local knowledge. They address the issues of community-based adaption (CBA) through the critique and experiences of participatory development. CBA is based on the idea that "local communities have the skills, experiences, local knowledge and networks to undertake locally appropriate activities that increase resilience and reduce vulnerability to...climate change" (Dodman and Mitlin 2011:1-2). They however argue that CBA must learn from the previous experience of participatory development in order for it to support pro-poor development. Several of these experiences are issues that are presented under the critique of local knowledge such as the tendency to assume that communities are simple homogeneous entities and ignore the fact that communities often have a variety of power relations and that some community members may be excluded from participating (Dodman and Mitlin 2001:6) .

Dodman and Mitlin's (2011) critique in addition to the critique of local knowledge presented above will help bring a balanced discussion on the issues of climate change and local knowledge and can therefore be an important contribution to further understand the potentials as well as the limitations of utilising local knowledge in climate change adaption.

Theoretical framework

The flowchart in figure 3.3 illustrates the literature and theories presented above and how it has guided the research. It is mainly influenced by the argument that local knowledge, through participation, combined with scientific knowledge enhances adaptation programmes as they produce tailor made programmes that are rich on local content.

Figure 3.3: Theoretical framework



Source: Author

The programme facilitators experience increased efficiency, reduced conflicts between programme and community and reduced expenditures during design and implementation as money is not wasted on failed projects. The involvement of the local community also enhances sustainability. The local community become empowered through participation as their knowledge and involvement is valued, which increases self-esteem and self-confidence. Because the projects are rich on local content they are also easily understood. This factors increase the chance of a successful programme and therefore enhances the local communities chance to respond and adapt to climate change impacts through increased adaptive capacity and reduced vulnerability. The participation and communication should not be one time incident, but a continuously processes throughout the project.

Chapter Four: Methodology

Qualitative Research

A qualitative research approach was chosen for the study, as it was believed that it would better equip the researcher to answer the objectives and research questions of the study. According to Goodwin (2006:29) qualitative research allows the researcher to "investigate people's beliefs, values and action. They allow us to examine the meanings of the social activities and enable us to situate these in a proper social context". The focus for this study is the people. It is about their experience with climate change, their involvement in the Lake Chilwa Basin Climate Change Adaptation Programme (LCBCCAP) and how the Women Fish Processing Groups (WFPGs) have enhanced their adaptive capacity. It is about local participation in the programme and understanding the result and outcome of that process. Qualitative research provides excellent tools for gaining such in-depth information.

Case Study

The research has been conducted as a case study on the LCBCCAP and more specifically the WFPGs. The rational for choosing a case study approach is related to the benefits of being able to study the LCBCCAP and the WFPG in detail. The case study approach allows research to devote all the time and resources on one specific case and it therefore implies that the study will be more in-depth than researches that have several focus points (Bryman 2008:54). The strength of a case study is that it does not only focus on the outcome, but also the processes. In that sense it "offers the opportunity to explain why certain outcomes might happen" (Denscombe 2007:36). This is beneficial as the study intent do look at the processes involved in designing the project as well as the process of enhancing the women's adaptive capacity.

Criticism has been raised against case studies concerning the issue of generalisation. How can findings be generalised to other studies when the findings are related to a specific context? According to Denscombe (2007:43) findings from several case studies can to some extent be generalised or compared to other cases if they have similar features. For example the findings from this study may be compared to findings from other similar climate change adaptation programmes. The relevance increases if the programmes are located in the same region as they will deal with similar issues related to development and climate change.

The rational for focusing on LCBCCAP is linked to the programmes relevance to the topic and theoretical issues of the study. The programme was considered to be an ideal case since LCBCCAP works with climate change adaptation and because they argue for the importance and claim to use local knowledge.

Sampling

The purposive sampling technique was chosen for this study in order to select respondents that are relevant for the study. The sampling technique is commonly used for qualitative research and especially small-scale projects (Bryman 2008:375,458, Denscombe 2007:17). Because purposive sampling is under the category of non-probability sampling it entails that the respondents are not randomly selected but rather 'handpicked'. It also implies that findings cannot be generalised to the enlarged population nor can one assume that the respondents represent the overall population (Denscombe 2007:13). However for this research it is not seen as necessary nor is it the intention for the research to reveal the general Malawian's experience with climate change and their local knowledge, but rather focus on how the LCBCCAP has utilised local knowledge in order to enhance the climate change adaptation programme. However, as argued, the findings can be compared to similar cases.

As mentioned above, the LCBCCAP was selected due to its relevance to the topic and theoretical issues of the study. The WFPG was selected on similar terms. LCBCCAP has numerous projects within their programme. The WFPG was chosen after an introduction to some of the projects. Because there were only three women groups with eleven to fifteen members it was decided that it would be beneficial to have respondents from all of the groups. It was further decided that it would be sufficient to have individual interviews with approximately half of the members and focus group discussions with the rest of the members from each women group. It was a good plan in theory, but rather challenging to carry out. Getting in touch with the WFPG members was challenging from Zomba City where I stayed during fieldwork. I relied on staff from the Department of Fisheries to plan the meetings. They sent out the message that I was coming, but we never knew how many of the women were available before the meeting started. When we arrived, all the women that were available showed up at the same time. Not to keep them waiting, the focus groups were held prior to the personal interviews and all women present attended. After, six women stayed behind to participate in the personal interviews. This may have affected how the women

responded to the personal interviews as there are similar questions in both the personal interviews and the focus groups.

In addition to talking with the beneficiaries of the project interviews were also held with Leadership for Environment and Development Southern and Easter Africa (LEAD), WorldFish Centre (WFC) and Department of Fisheries (DoF). Purposive sampling was used to select respondents in both of the categories. The respondents that were chosen were picked because it was believed that they had valuable information and insight into the programme, the WFPG and the way the programme was designed and implemented. Table 4.1 presents the complete list of respondents of the study.

Table 4.1: Complete list of respondents

Category	Respondents	Codes	Type of interview
Women Fish Processing Group Members	19 (F)	K1-K6 S7-S12 T13-T18	Semi-structured interview
LEAD	1 (M)		Semi-structured interview
WorldFish Centre	2 (M)		Semi-structured interview
Department of Fisheries	2 (M)		Semi-structured interview
Focus Group with Kachulu WFPG	6 (F)	FGK	Focus Group Discussion
Focus Group with Swang'oma WFPG	9 (F)	FGS	Focus Group Discussion
Focus Group with Tadala WFPG	12 (F)	FGT	Focus Group Discussion

In the text I will use codes when referring to WFPG members. However, I only interviewed one staff from LEAD and one from WFC. I will therefore refer to them by using their names as this is ok with them. The respondent from LEAD is the Programme Manager, Welton Phalira, and Chrispine Botha is employed as Agribusiness Officer at WFC. When referring to the respondents from the DoF, I will refer to the DoF and keep them anonymous.

Data Collection and Methods

The data collection took place over a period of two months from mid-January to mid-March, 2012. Both of the months were spent with LEAD in Zomba who coordinates the LCBCCAP. From Zomba I took several fieldtrips to the WFPG that are located in Kachulu, Swang'oma and Manguluni. The interviews were carried out at the natural settings of the respondents, meaning either at LEADs office, WFCs office or in the communities at the WFPG sites. An interpreter assisted me for the interviews with the WFPG members.

One of the strengths of a case study approach is that it allows and encourages the researcher to use multiple methods of collecting data (Denscombe 2007:37). In order to get a sufficient and comprehensive understanding of the research topic four methods were selected to collect data: semi-structured interviews, focus groups, participatory observation and documents. Using multiple sources of data collecting methods ensures that the researcher gains a more complete picture. This is known as methodological-triangulation, which increases researches reliability and validity of the study (Denscombe 2007:138). Data-triangulation was also used as I asked different groups of informant's (WFPG members, LCBCCAP staff [LEAD, WFC], LCBCCAP stakeholder [DoF]) similar questions. This ensures that the study gets a clearer picture of how the different stakeholders interpret the effect of climate change in the local area and how LCBCCAP has utilised local knowledge.

Semi-structured Interviews

Semi-structured interviews were used for WFPG members, LEAD and WFC and DoF. Three different interview guides were made for each group (WFPG members, LCBCCAP staff and DoF). A pilot test was carried out for the WFPG member's interview guides as it was important to gather a wide range of information. The pilot test revealed that it was necessary to clarify and add some questions. For example, I realised that the women did not understand me when I used the term local knowledge. However, they did understand participation and the questions were therefore changed accordingly. For the other two groups it was not seen as necessary to pilot test the interview guides as they were less complex. However, some questions were added during the interviews. The interviews were based on the interview guides, but the structures of the interviews were flexible and several of the questions were open-ended, which allowed the interviewee to respond freely (Bryman 2008:231,438). The interview guides were designed to give a critical insight into the topic and answers to the research questions. All semi-structured interviews were one-to-one interview, but an interpreter was involved for all interviews held with the WFPG members. The interpreter also held some of the interviews with the WFPG members alone, but the notes were thoroughly reviewed after the interview, which allowed questions or corrections to be made. It was not necessary to have an interpreter with the other respondents as they spoke English.

Focus Group

Focus groups are essentially a group interview where topics are discussed in-depth. More accurately focus group discussions reveal how "individuals discuss a certain issue as members of a group" (Bryman 2008:473). The focus groups were of importance to the study as it provided an opportunity for the WFPG members to collaboratively discuss the programme and climate change adaptation. If any major disagreements or discontent existed amongst the WFPG members the focus groups could reveal such issues. However, the women seemed to have similar experiences and share the same positive opinions about the project. The issues raised were similar to the topics from the semi-structured questions, but more importance was given to group dynamics and group information. While the answers from the semi-structured interviews provide specific information on individual members, the focus groups gives a more general understanding of the women's experience with climate change and their involvement with LCBCCAP. The topics that were discussed and the feedback were also of value in relation to triangulation. The information from the semi-structured interviews can easily be compared and confirmed with the answers from the focus groups.

Conducting focus groups is nevertheless challenging and especially when using an interpreter. In this case the interpreter took on the role as the moderator and translated the discussion for me so that I could take notes. Since the focus group is about encouraging the participants to have a discussion, stopping to translate restricts the discussion to develop freely. It is also challenging to attain all information as the discussion is not translated word for word, but rather as a summary. Regulating the size of the focus group was also challenging. As explained above, the initial plan was to have focus groups with half of the members from one WFPG. Six to nine is regarded as an appropriate number for a focus group as it allows all the participants to share their opinions and experiences (Denscombe 2007:181). However, due to complications the focus groups included between six to twelve WFPG members and it was common that some of the participants either came late or left early. For the focus group with the Tadala WFPG, where twelve members were present, it became difficult to ensure that all members were heard. However, this was also challenging with the two other focus groups as there were some members who dominated the discussions, restricting the less confident members to speak despite encouraging all the members to participate.

Observation

Non-participant observation was used to collect information and images from the three WFPGs and their given locations. The term non-participant observation refers to a situation where observer observes, but does not participate in the social setting (Bryman 2008:257). Observations were made before, after and during interviews. I also joined WFC to collect packaged fish from Swang'oma WFPG and Tadala WFPG. This trip was especially fruitful as they showed me the process of packaging fish and how the women worked together. The observations were especially helpful for gaining an understanding of the operation of the project and how the women processed fish versus the traditional methods of processing fish. Visiting the communities and observing both methods helped identify the benefits and challenges of the WFPGs. It also gave an insight into how the people of the basin live in the rural areas. Trips were also made to the lake and the beach in Kachulu where fishermen sell their fish. This gave valuable insight into the fish sector in the basin.

Documents

Documents that are of relevance to the topic have been gathered in order to gain a broader understanding of Malawi, climate change, LCBCCAP, the WFPGs. These are government publications, official statistics, studies conducted for LCBCCAP, reports from LCBCCAP, reports from other NGOs working in Malawi and newspaper articles from Malawi that elucidates the topic of the study. Because these are secondary data, the reliability of the documents needs to be in mind. For example, national statistics from Malawi are known to be scarce and much of the data is outdated. There are also reasons to be sceptical about the reliability of the data. Further, unpublished reports are not peer-reviewed and hence the reliability of the data should be questioned. The documents will nevertheless be valuable as they increase the understanding of the specific context and topic of the study. LCBCCAP's reports are especially important when analysing their use of local knowledge as they will shade light on how they intend to carry it out. Academic articles and studies on relevant topics have also been reviewed. While such documents will be used as they help elucidate the topic and context, the thesis will supplement with academic literature for theoretical material when analysing and discussing the topics.

Data Analysis

Case studies have more often than not been used to 'discover information' than to test theories. However, case studies are not restricted to either inductive or deductive logic (Denscombe 2007:38). This study takes on a deductive approach as it seeks to 'test' the theory of local knowledge (Bryman 2008:9). Utilising local knowledge has been seen as a panacea to development as top-down approaches have failed to provide successful outcomes (Agrawal 1995, Smith 2011). This study therefore seeks to examine the hypothesis that utilising local knowledge enhances climate change adaptation projects by assessing how local knowledge and participation has influenced the development of the WFPGs. In order to get a complete picture of the project and utilising local knowledge has affected the project, the study will assess how people are affected by climate change and how the WFPG affected the women's adaptive capacity. This will give valuable information about how successful the project is, which can be used when analysing the use and effect of local knowledge for LCBCCAP.

In practice, the data from the semi-structured interviews from the WFPGs was thematically organised into documents. One document was made for each research question and the relevant responses were added to the documents. The responses from each WFPG were listed together. This helped clarify the responses and categorise them for further analysis. It must nevertheless be noted that the groups are not analysed separately. A response from a specific group might be highlighted, but the purpose of the study is not to compare the groups, but gathered as much information about the WFPG as possible. In order to separate between the WFPG members, each women has been given a code made out of the first letter of the members group and a number. The women and their codes are listed at the very end of chapter two. Because the data from LEAD, WFC and DoF is of smaller amounts, it was not seen as necessary to group the responses. Further, Excel has been used to present data through figures and tables.

Ethical Considerations

Diener and Grandall (in Bryman 2008:118) list four main areas of ethical principles: harm to participant, lack of informed consent, invasion of privacy and deception.

These principles were all reflected upon prior to collecting data, and at all times during the fieldwork it was ensured that the ethical principles were not crossed. While staff working for LCBCCAP was fully aware of the study, the WFPG members were thoroughly introduced to the purpose and topic of the study. Even though LEAD and WFC assisted me in field, the women understood that I did not represent them. All respondents participated voluntarily and their identities are held confidential, despite none objecting to having their names in the thesis. This is positive as the women may be easily recognised as the programme and specific project is known.

Limitations

During data collection there were certain issues that made the process challenging. I stayed in Zomba City while collecting data. Traveling to Kachulu and Phalombe to get to the WFPGs was challenging as there was a lack of public transport to these areas and in order to get there it was necessary to use a 4WD due to poor road conditions. While it was possible to take a taxi to Kachulu, there were no such options to Phalombe as taxi drivers were reluctant to drive there due to the distance and the road conditions. In addition, some days it was not possible to drive due to lack of fuel in the country. I nevertheless managed to get to the WFPGs by using taxi and assistance from LEAD.

Because of the distance to the women groups and lack of possibilities of staying there it was not possible to spend more time with the women except when conducting the interviews. If there was more time to thoroughly explain to the women what the study was about and to observe them in their daily life and while working, I might have been able to get more informative answers as well as compare their responses with their actions. Further, it would be interesting to gain a more in-depth understanding of the local practices and local knowledge related to topics such as climate change and fish processing. However, as acknowledged by Sillitoe (2006:8) for someone who is unfamiliar with a region it may take years to gain an in-depth understanding of local practices and local knowledge (Sillitoe 2006:8). I also experienced that it was difficult to gather information about use of local knowledge from the women as well as the DoF staff, as they had problems with understanding the concept. Climate change is a topic that is challenging to study for the same reason. It takes years to document if changes are a sign of climate variability or climate change. The study relies on scientific studies conducted on climate change in Malawi, but

even these do not provide a homogeneous answer. It is however important to state that it is not an aim of the thesis to documenting whether the changes acknowledged by the WFPG members are a sign of climate change. This is a social science research and the focus is on the people's perceptions and their own experiences, regardless of whether the environmental factors are actually climate change or not.

The language barrier is another major challenge. Without any Chichewa knowledge, which is one of Malawi's official languages and one of the most dominant languages in the region, it was impossible to communicate with the women in the groups without an interpreter. This created a distance between me and the interviewee, which I found affected the quality of the data collected. It became challenging to be in charge of the interviews as it was difficult to follow. There is no doubt that some valuable information gets 'lost in translation', either due to the fact that the interpreter failed to inform of everything said or simply because when interpreting it may be challenging to get across the exact same meaning in a different language. Despite the fact that these issues limited the data collection and quality of the data, it is argued that the collected data is of good enough quality in order to use it for the analysis of the study.

As stated above, LEAD and WFC assisted me throughout my fieldwork. Even though the women seemed to understand that I did not represent them, my affiliation with the organisations may have affected how the women respondent. There was hardly any criticism towards the programme, which might have been different had I not been accompanied by LEAD or WFC.

Chapter Five: Living with Climate Change

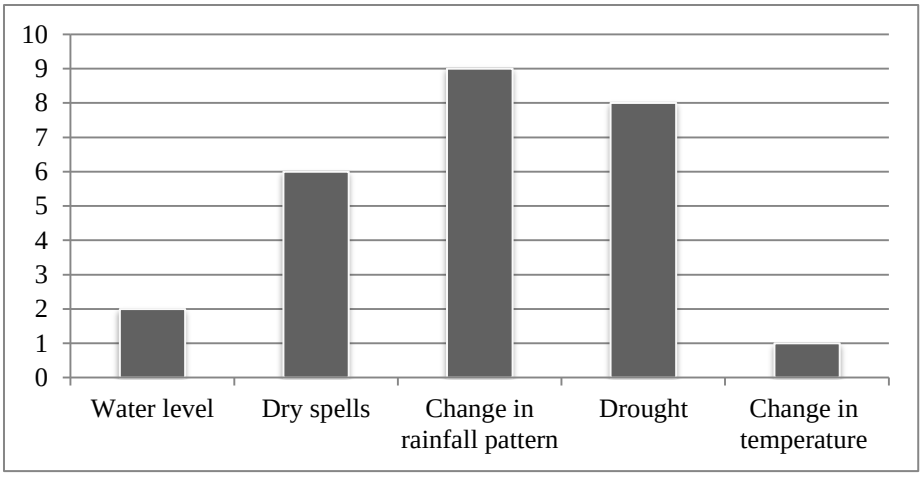
It has been noted that it is the poor living in developing countries that will be exposed to the worst of effects of climate change, despite the fact that they have done little to cause it (Adger et al. 2003:180). This has to do with the geographical position of the countries in questions, but also with their high level of vulnerability to change and reliance on natural resources. There is a consensus amongst researchers that the more socially and economically marginalised people are, the more vulnerable they will be to the effects of climate change (MacGregor 2010:130). Because poor rural women are considered to be some of the world's most vulnerable, social research anticipate that they will be affected to a greater extent than men (Arora-Jonsson 2011:744). It is therefore important to gain a better understanding of the experiences of poor women with climate change and how they have been affected by it. This chapter will answer to the first research question by presenting the experiences the women in the Women Fish Processing Group have had with climate variability and climate change and their own reflections on how the natural resources and themselves have been affected by these changes.

Experiencing Climate Change

For many, climate change is something that belongs to the future. However, the women in the WFPG are completely unanimous: the climate is changing in Zomba and Phalombe District in Southern Malawi. All of the eighteen women interviewed stated that they themselves have experienced changes in the climate in the past decades.

Asking the women about what they had experienced, the answers fell into five categories; changes in the rainfall pattern, increased amounts of dry spells during the rainy season, drought, higher temperatures and a decrease in the Lake Chilwa's water level. Figure 5.1 illustrates the distribution of responses. Some of the respondents gave more than one answer. All except the last category are linked to changes in the climate. Reduction in lake level may be seen as a consequence of less precipitation and/or higher temperatures resulting in an increase of evaporated water. This issue will therefore be discussed under the consequences of climate change further down. This section will focus on two categories: 1) change in precipitation, including change in rainfall pattern, dry spells and drought and 2) temperature.

Figure 5.1: The respondents experience with climate change



Source: Primary data

Change in Precipitation

Change in rainfall pattern and dry spells

There are two main seasons in Malawi, one dry and one wet. The rainy season normally starts in November and ends by the end of March and throughout the period they expect daily rain. The rain season is followed by a six months long dry season when hardly any rain (Njaya et al. 2011). As seen in figure 5.1, the most frequent response to what the women have experienced is change in rainfall pattern. This can also be understood as change in the rainy season. Any change to the start or end date of the rainy season is seen as a change in the rainfall pattern. In addition to the start and end date of the season, the change in rainfall pattern also has to do with the frequency of rain within the rainy season.

According to the respondents, the rainy seasons have become highly unpredictable in the past four to five years as they have been delayed, inconsistent and short. The women explain that they have experienced that the rain has come as erratic, unpredictable rain and there are longer drier periods within the rain season, also known as dry spells. The rainy season of 2011-2012 is a good example of the recent trend. The women explained that they expected the rain to start in November, but instead it started in late December and ended in February instead of March. When the rain came, it was erratic and frequently interrupted by dry spells. This is a deviation from what Njaya et al. (2011) describes to be the 'normal' rain season from November to March. However, there are quite distinct variations between the women's understanding of a normal rain season. While one woman claimed that the rain used to start in October, others said November or December and one woman stated that the rain season

sometimes did not stop before May. ActionAid (2006) has conducted a study on smallholder farmers in Malawi and their perceptions on climate change. The following comment by one of their respondents may help to clarify why different months are mentioned. According to Kabota Kanyara, 63 years,

> Previously rains used to start in October. We used to regard this as the rain that makes mangoes ripen or puts off bush fires. The pattern started changing in the 1970s when we started getting these rains in November. These days we get planting rains in December (ActionAid 2006:4).

In other words there has been a change from October to December and the reason why the women mention different months may be due to age difference and what their families have told them. While Kabota is an older man who lived through the 1970s, the majority of the respondents were either too young or not yet born, and are now in their late 20s or early 30s. It may however also be because the rainy seasons vary within the country and several of the women are not originally from the area.

According to the scientific studies conducted on precipitation trends in Malawi there has been no significant change in annual rainfall. However, as presented in chapter two, McSweeny et al. (2012) predictions for the future is that the rain will fall over a shorter period of time and cause heavier rainfall events. This is in line with how the women explained the rainy season of 2011-2012. Even though there is no reduction in the annual rainfall, unpredictable rainy seasons can be just as challenging for subsistence farmers as a reduction in rainfall. A study examining climate variability would be of interest in order to compare and evaluate the respondents' experiences, but as noted by Jury and Mwafulirwa (2002:1290) very little work has been done on Malawi and climate variability. The frequency of unpredictable rainy seasons is however an issue that has been mentioned in Action Aid (2006) and Kalanda-Joshua (2011). The effect of climate variability will be further discussed below.

Drought

Eight of the women interviewed mentioned that they have seen an increase in droughts in the recent years. As seen in figure 2.2, this is in line with ActionAids (2006) study, which indicates an increase in droughts. Since the 1980s Malawi has had ten serious droughts, the last occurring in 2008, 2005 and 2001. As mentioned in the chapter two, it is very likely that Malawi will continue to experience seasonal droughts as temperatures are predicted to

increase. The figure also indicates an even higher increase in floods, but this was not mentioned by any of the respondents. The most probable reason is that they do not live in a flood prone area.

Increased Temperatures

When asking the women about what changes they have experienced, only one responded noted that it had become warmer. According to the UNDPs climate profile and the Malawian Meteorological Department, the mean annual temperature in Malawi has increased by approximately 1°C since the 1960s. Consequently they have seen an increase in hot days and nights and fewer cold days and nights (EAD 2000, McSweeney et al. (2012). It is an interesting observation that the one degree change scientists are certain about when it comes to climate change in Malawi is not seen as a major issue for the respondents. The issue was, however, brought up in another context. One of the women explained that it had become increasingly difficult to work outside during the day due to warmer days. The women linked the issue to the fact that there are fewer trees than before. Because most Malawians use firewood, huge amounts of trees are cut down on a regular basis. Without the shade from the trees the temperature feels significantly warmer.

Climate Change or Climate Variability

While it is evident that the women have experienced certain changes in the weather, this study cannot conclude whether the changes they have experienced are due to climate change or climate variability. Nevertheless, when comparing the findings with the scientific reports it is clear that some of the experiences the women have had are in line with the findings of the changes that have already taken place, such as an increase in temperature and droughts. Some of the predicted scenarios for the future have also been experienced, such as the shorter rainy reasons with higher intensity rainfall.

While it is of scientific importance to find out if changes are a sign of shifts in a long-term trend or simply a short-term trend, it is not the focus of this thesis. Whether or not the changes are linked to climate change is not essential for this thesis for several reasons. First of all, the study falls within socials sciences where the focus is on the people and the changes that they are experiencing. Their consequences are a reality to them and hence they have to find ways of coping with the changes. Second, it is predicted that climate changes will occur

and the aim for LCBCCAP is to reduce the local population's vulnerability towards the future scenarios by improving household adaptive capacity. It is therefore argued that it is sufficient to present the experiences that the women have had and examine how these changes affect their daily lives and the natural resources that they depend on. The latter is the focus of the following section.

Consequences and Challenges

The changes in the climate generate new challenges for the women and the people living in the area as well as affecting the local eco-system and the natural resources that the people depend on. This section will present the effects the changes have on the natural resources as well as the socio-economic issues raised by the respondents. At last, the section will address the issue of how gender influences the way people are affected by climate change.

Natural Resources

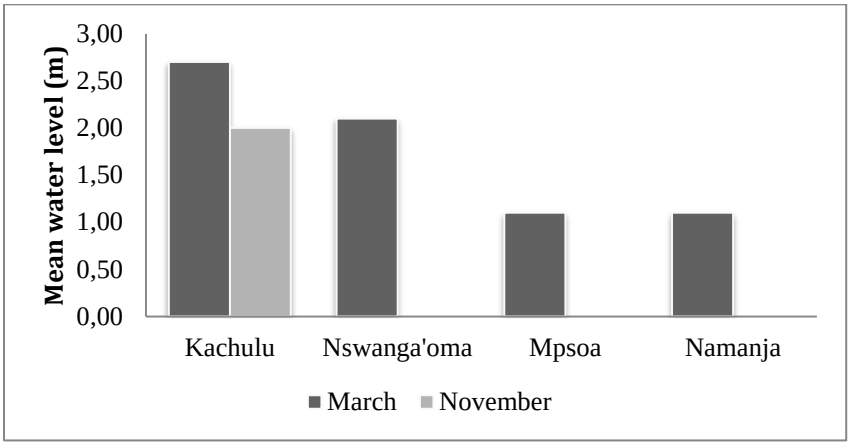
The Lake

The Lake Chilwa wetland is extremely important for the economy of the basin, as the fish sector contributes up to USD 17 million a year. However, the lake is regarded as economically unstable due to the seasonal and long-term fluctuations in the lake level (Njaya et al. 2011:18). As mentioned in chapter two, Lake Chilwa has dried up nine times in the past century. The concern is that climate change may contribute towards drying up the lake more frequently, making the basin economically vulnerable.

When asking the women about the effects of the climate change, the majority of the women replied that they worried about the lake drying up. The members of the three WFPG all work and live close to the lake. They daily observing it and they notice if the water level changes. According to the women, the years with poor rainy seasons has resulted in low water levels and they fear that the lake will soon dry up again.

The problem is not that the lake water is low, but that it is low also in the rainy season. According to one respondent T15 "the lake should have been full by now". If the lake does not fill up during the wet season, there is a chance that it will dry up during the dry season. Especially if there has been poor rain seasons the previous years. The two graphs illustrate the fluctuation of the water level at four gauging stations and indicate that the water level is substantially higher during the rainy season.

Figure 5.2: Lake Chilwa's mean water level in March 2011 and November 2011



Source: modified from Chapotera (2011)

As seen in figure 5.2, the lake had dried up at three stations in November 2011, but according to Chapotera who is in charge of monitoring the water level for WFC, this is regarded as normal. The following month was the month the rainy season started and as the area received some rain, the lake refilled. Chapotera expressed that she is not concerned about the lake drying up in 2012, but that it might do so the following year if they are to receive another poor rain season.

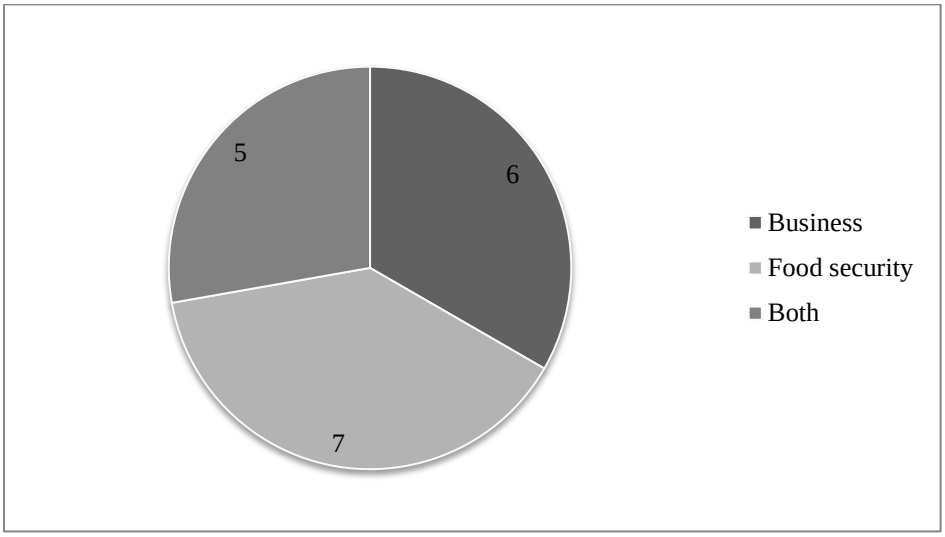
Fish

The women have also noticed a decrease in the fish catch due to the lower water levels. This may be correct as Njaya et al. (2011:21) explains that there is a statistically significant correlation between the water level and fish catch. The women have noticed that the number of people who are involved in the fish sector has increased in the last years, putting more pressure on the resources and may result in overfishing. The women link the increase in the number of people employed in the fish sector to the decline in productivity of the agricultural sector. A study conducted by Chiwaulu and Chaweza (2010:29) for WFC on the fish value chain for Lake Chilwa Basin had similar findings. The study established that the fish catch have decreased in the past ten years due to the water level decreasing and because of the increased numbers of fishers due to population growth.

Socio-economic Issues

Figure 5.3 shows the respondent's perception of how climate change affects their lives. Six of the respondents explained that it affected their business and another seven said it affected their crops and hence their food security. The last five respondents stated that their food security is threatened because their business has been reduced. In the figure, this response is shown as 'both'.

Figure 5.3: The respondents' perception of how they are affected by climate change



Source: Primary data

Business

Fish processing is the women's main source of income and only two of the women (K4 – brews sweet beer, K5 – boat making business) have another income generating activity. However, eight women (including K4) are also involved in *ganyu* when facing economic difficulties. *Ganyu* is one of the most common forms of livelihood strategies for poor in Malawi and is either paid in cash or in food. It refers to casual daily wage labour and the work is often, but not exclusively unskilled and agricultural based (Simtowe 2010:206-207). Two women from the Tadala WFPG remarked that they fetch water as *ganyu* during economic difficulties. Because both the fish sector and agriculture are seasonal, it is common to substitute between the main occupation and *ganyu* in order to get by during low seasons (EAD 2003:16).[8] The multiple income sources indicate that some of the women do diversify their livelihood to some degree which makes them less vulnerable to low periods in one sector

[8] The lake is almost entirely closed for fishing between December and March, farming is only possible during the rainy season between November and March (Nagoli 2010, Njaya et al. 2011).

(Simtowe 2010:204). Livelihood diversification has been identified as an important strategy for coping with natural hazards or in order to adapt to climate changes (Ellis 2000, Nelson et al. 2009, Simtowe 2010). The topic will therefore be further discussed in chapter six.

It is nevertheless evident that the women are highly dependent on the lake's resources for their income. If the lake was to dry up, the women would be left without a regular means of income until the lake refills, which takes about two years (Njaya et al. 2011:21). If the lake dries up more frequently, the women's main source of income would be seriously threatened and the women would have to consider changing their occupation. While it is a concern that belongs to the future, the women have already noticed some worrying trends that relate to the changing climate. Due to the drop in the fish catch and the increase in people working in the fish sector, the fish prices have increased and consequently they are not able to buy as much fish to process as they used to which reduces their income. In addition, the women from the Swang'oma and Tadala also complained over having to walk further to buy fish as the lake is contracting due to decreasing water levels. In an already busy day, this is placing an extra burden on the women.

Food security and subsistence farming

In the Lake Chilwa Basin 85 per cent of the population rely on rainfed subsistence farming for their food consumption (Njaya et al. 2011:16), compared to more than 75 per cent nationally (Simtowe 2010:204). Since it is impossible to cultivate without irrigation during the dry season, it is crucial that the rain season is predictable and stable for the household to be able to harvest as much food as possible. The poor rainy seasons are therefore threatening the Malawian way of life by making subsistence farming an unsecure method for obtaining food.

According to the women, the past four years have been tough, as their garden plots have produced fewer crops. During the focus group with Tadala WFPG, the women explained that they had tried different types of crops such as hybrid maize, groundnuts, pigeon peas and cassava, but none have produced satisfying results. The Tadala WFPG members stated that fish processing is the only means of income that produces high enough income for them.

One of the main challenges for the people in Malawi is knowing when to plant. In Africa, farmers have usually relied on their local knowledge to make decisions regarding sowing (Kalanda-Joshua et al. 2011:997). According to the WFPG members it used to be common to plant when the first rain came. At that time it was considered a safe procedure as the rain

usually continued to come consistently. Now they are finding that the rain is not as predictable as a dry spell might appear right after the first rain. The planted crops will then fail to grow and consequently the households will have to plant again. One of the women (K4) explained that she had planted maize three times this season, but every time it had withered due to lack of rain. She explained that it was a costly affair to replant and that such events pushed them even further into poverty. She had no plans of trying again which means that she has to purchase food for the next year.

Several studies have similar findings (ActionAids 2006, Nagoli 2010, Kalanda-Joshua et al. 2011). In ActionAids (2006) study on climate change and smallholder farmers in Malawi, farmers complained about changes in the rainfall pattern and higher temperatures, which has made it difficult to know when to plant and additionally reduced the harvest. Climate variability is therefore making local knowledge less reliable and it is threatening their main source of knowledge (Kalanda-Joshua et al. 2011:977). As a result, Kalanda-Joshua et al. (2011) argue for the importance of enhancing localised climate and weather forecast to guide farm level decision making.

An improved localised weather forecast may improve farming productivity. However, the findings indicate an overall trend amongst the WFPG members that they are moving away from subsistence farming due to the low outputs. If the climate continues to change and the rural farmers are not given sufficient guidance, climate change may be changing the very structure of Malawians' livelihood strategies.

Gender and Climate Change

The chapter started off by acknowledging that women may be more vulnerable to climate change than men. According to Adger et al. (2007:719) "women in subsistence farming communities are disproportionately burdened with the cost of recovery and coping with draught in southern Africa". On a national level, policy makers in Malawi acknowledged that gender is an important topic in climate change adaptation. In Malawi´s National Adaptation Programmes of Action (NAPA) gender is identified as one of the eight focus areas that need to be addressed when identifying and promoting adaptation strategies. This is because

> Women bear most of the burden in activities that are most impacted by adverse climate, including collection of water, firewood and ensuring daily access to food. In addition, the changing demographics as a result of the impacts of the HIV/AIDS epidemic, are leading to women taking up greater responsibilities as sole heads of

households and taking care of the sick and orphans (EAD 2006 x-xi).

However, the women from the fish processing groups do not confirm the statement. Out of all of the respondents, none replied that climate change affects women and men differently. According to respondent K6 women and men equally struggle with the changes as they both work in the fish sector. Another woman (S8) explained that there is no difference in the way women and men are affected as they both work to supply food for their families.

It seemed like the majority of the women interpreted the question in relation to their business and failed to acknowledge gender roles that separate the women and men's responsibilities within the home and society. In the discourse of gender and climate change, gender roles are often emphasised in order to explain how women and men will or are affected differently by climate change (MacGregor 2010:130). Respondents might have discussed such issues if specific questions related to gender roles were asked. A specific study that addressed how the effects of climate change affects gender roles within the communities could therefore be interesting.

Living with Climate Change in the Basin

The changing climate is pushing the people living in the Lake Chilwa Basin further into poverty by affecting the natural resources they depend on. Unpredictable rainy seasons have made subsistence farming challenging and there is a concern that Lake Chilwa will dry up more frequently. It is questionable whether or not the changes are a result of climate change and hence a long-term trend or if it is a result of climate variability and therefore a short-term trend. However, the WFPG members express that the changes are a serious threat to the livelihood and food security of the whole Lake Chilwa Basin. The next chapter will address the WFPG members' ability to adapt to and cope with these changes by assessing their adaptive capacity and if and how LCBCCAP may have enhanced it.

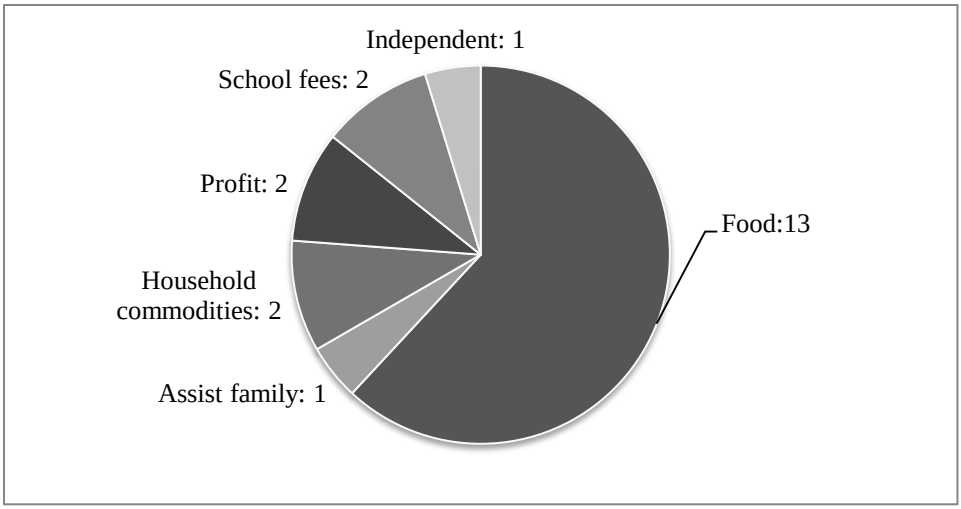
Chapter Six: Adapting to Climate Change

The unpredictable rainfall pattern, the increasing temperatures and the threat of Lake Chilwa drying up are factors that threaten livelihoods of the residents of Lake Chilwa Basin and Malawi's development at large. Through the Women Fish Processing Groups (WFPG) Lake Chilwa Basin Climate Change Adaptation Programme (LCBBCAP) seeks to assist women working in fish processing to adapt to the changes by enhancing their adaptive capacity. The extent to which LCBCCAP has succeeded to increase the WFPG member's adaptive capacity will be examined in this chapter. The chapter responds to the first sub objective and second research question by first presenting the WFPG members opinion about how the project has helped them adapt to climatic changes and second by assessing how WFPG has affected the member's adaptive capacity.

WFPG Influence on Adaptation

Climate change adaptation refers to "the adjustment of a system to moderate the impacts of climate change, to take advantage of new opportunities or to cope with the consequences" (Adger et al. 2003:192). A relevant question to ask would then be has LCBCCAP improved the WFPGs ability to moderate the impacts of climate change? According to the women, they have. Seventeen out of seventeen women agreed that the WFPG is helping them to adapt to the climate variability presented in chapter five. Figure 6.1 illustrates the frequency of the responses that were given to the question of 'how has WFPG helped you to adapt to climate change?' Some of the women gave more than one answer. All of the answers are related to the increase in income the women have experienced since joining the WFPG and some relate to how the money is spent. Not all the responses are directly related to adaptation, but the figure clearly illustrates the importance of the income. The most frequent answer is related to food. As discussed in the previous chapter the common practice of subsistence farming is threatened by unpredictable rain patterns. According to the women, people no longer feel that they can rely on their harvest to supply them throughout the year with food anymore. The increased income is therefore of great importance, as it allows the women not to worry about harvesting enough; the income is sufficient for purchasing food.

Figure 6.1: Response to how WFPG is helping members to adapt



Source: Primary data

According to Boko et al. (2007:435) there is a high consensus that climate change and climate variability will affect agricultural production and food security in sub-Saharan Africa. Malawi's National Adaptation Programmes of Action (NAPA) has identified food security as one of the most important issues that needs to be addressed in relation to climate change. Recent floods and droughts have led to critical food shortages and such events are predicted to increase in quantity (EAD 2006:6). As the WFPG increases the women's food security, LCBCCAP is indeed helping them adapt to one of the core challenges of climate change facing Africa and rural poor depending on natural resources.

Assessing Adaptive Capacity

The study has established that the WFPG members believe LCBCCAP has assisted them in adapting to climate change, but the question remains whether the women's involvement in the WFPG has increased their adaptive capacity. If LCBCCAP has contributed towards enhancing the women's adaptive capacity, the women will not only be able to deal with present issues of food insecurity, but will also have improved in their overall ability to respond successfully to climate variability and change (Adger et al. 2007:727).

The aim is not to quantify adaptive capacity, but to discuss the most relevant factors that affect the women's adaptive capacity and their asset status, as well as identifying how LCBCCAP contributes towards increasing their asset status and consequently build adaptive capacity. No individual assessment of the WFPG members will be undertaken, even though

individuals will be highlighted. The main aim is to understand how the project affects adaptive capacity, and the women will therefore be treated as a social group, focusing on their general adaptive capacity. The framework used for assessing the adaptive capacity of the WFPG members is presented in chapter three and is based Nelson et al. (2009) conceptual framework for assessing adaptive capacity, which is based on Ellis (2000) rural livelihoods framework. The framework enables a holistic evaluation of adaptive capacity by assessing financial, physical, social, natural, and human capital.

Financial Capital

Financial capital is understood as "the stocks of financial resources to which households have access to, including cash, incomes, access to other financial resources (credit and savings) and overall wealth that influences the ability to generate income" (Nelson 2009b:3). Financial capital has been regarded as a key aspect of adaptive capacity as money can easily be transformed to necessary assets (Nyong et al. 2007:792). The financial capital available to the WFPG members is primarily household income and savings. Both will be addressed when assessing LCBCCAP influence of the WFPG member's adaptive capacity. The reliability of the data can be questioned since it is retrieved from the women's memory and several of the women expressed that prior to the business training provided by LCBCCAP, they had little experience with calculating income. In addition, the women might have expressed that they have less income than they actually have. This may be because of issues such as being cautious about other people knowing how much cash they keep in their home or similar issues. The statistics from Kachulu was purposely left out because the data did not present the effect the project has had on the women's income. This is because the group has experienced two major obstacles since they started in July 2011. The solar driers broke after a few weeks and the closed fishing season started only a few months after the group was established.[9] It is nevertheless argued that the data from Swang'oma and Tadala group is sufficient to illustrate the projects influence on the women's income. The income is given in Malawian Kwacha and presents the women's weekly income and savings.[10] The women acknowledged that there

[9] After the lake refilled in 1997, a closed fishing season of four months was introduced in order to conserve fish stocks. The lake is closed for fishing with seine nets from December to March (Njaya 2001:20).
[10] At the time of data collection, the exchange rate was approximately 1 USD =165 MKWA (XE:04.05.12). The Malawian Kwacha was shortly after (May 2012) devaluated by 33 per cent to restore donor funding, making 1 USD = 250 MKWA (BBC 2012).

are great variations in weekly income throughout the year due to issues such as fish catch and the harvest, but an estimated average was provided by the women.

Income

The women's income is important for their adaptive capacity since money can be used to access other assets needed to respond to natural hazards or to prepare for long-term climate changes (Nelson 2009b:4). One of the objectives for LCBCCAP for the WFPG is to increase the members' income in order to enhance household adaptive capacity. The new methods of processing fish introduced to the women are predicted to increase the women's income as the quality of the product is improved.

Table 6.1: Income before and after joining WFPG

Respondent	Present Income	Previous Income	Difference	Increase in income
S7	3000	1000	2000	200 %
S8	5000	1250	3750	300 %
S9	2000	1500	500	33 %
S10	600	300	300	100 %
S11	2000	1000	1000	100 %
S12	2500	600	1900	317 %
T13	3000	1000	2000	200 %
T14	3000	1000	2000	200 %
T15	4000	1500	2500	167 %
T16	5000	1000	4000	400 %
T17	2000	1000	1000	100 %
T18	5000	500	4500	900 %
Mean	3091	971	2120	218 %

Source: Primary data

Table 6.1 presents the women's income before becoming a member of the WFPG and after. The groups were established in the months of June, July and August 2011, meaning that the groups had been operating between seven and nine months at the time of data collection. Table 6.1 indicates that every member's income has increased after joining WFPGs and everyone except one (S9) has doubled their income. This data is only from the women's personal business as the group business data was not available. Despite the fact that their

income has increased substantially, the women will still be under the poverty line of one dollar a day.[11]

Even though the statistics indicate that their income has increased, all the groups identified capital as one of their main obstacles for expanding their business (FGK, FGS, FGT). They explained that if they had more capital they could process higher quantities at the same time and consequently increase their income. Despite indicating financial capital as an obstacle to further development, the women managed to save some of their income.

Savings

Savings is considered important within financial capital as it is an asset that is easily accessible if a crisis occurs. An aim for LCBCCAP is therefore to enhance saving skill so that they will be able to cope during emergencies and unpredicted expenses that often are related to climate variability and change. According to Botha, rural Malawian's rarely save money, either because they do not have enough capital or because they do not have access to financial institutions. The "Livelihood Analysis Report" conducted by WFC for the LCBCCAP Nagoli (2010:18) explains that there are few credit facilities in the communities except those found in the urban centres. However, people in the rural areas have promoted the development of traditional savings and credit systems known as village or rural banks. The statement made by Botha is partially confirmed by one of the WFPG members who stated that "prior to the project we did not know that we could keep money in the bank" (T18). Nonetheless, it is not correct that they did not save money. The findings indicate that 13 out of 18 women were saving money prior to the project. However, out of the three groups, only the women in Kachulu WFPG had access to a village bank. The women from Swang'oma and Tadala WFPG either kept their savings at home or with family members.

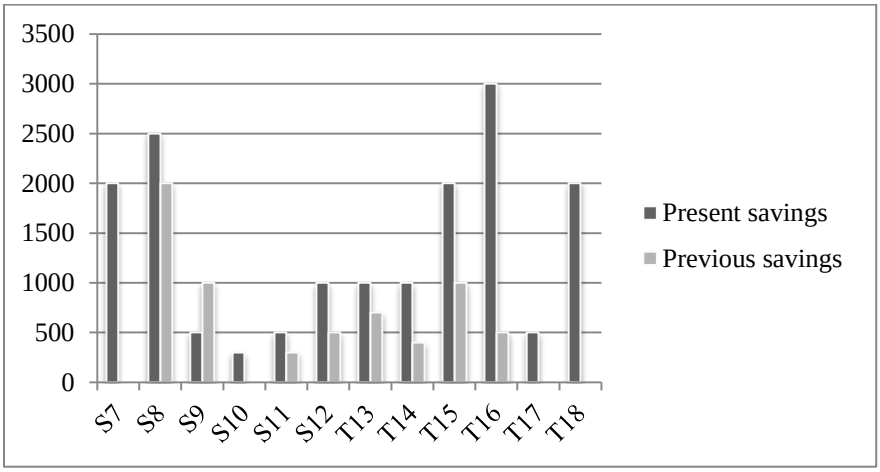
The findings indicate that the project nevertheless had a significant impact on the women's ability to save money. Prior to the project, 5 out of 18 women did not save any money, but at the time of data collection all women reported that they had enough money to save on a weekly basis. Figure 6.2 illustrates how much the women saved before participating in the

[11] A simplified calculation illustrates the mater. The mean income is 3091 MKWA, equivalent to approximately 3USD and 16 out of 18 women have more than four dependents. (3091/5)/7=88 88MKWA =0.53 USD.

project and after. The issue about reliability of data is also relevant for savings and the data from Kachulu is not included for the same reason as discussed above.

The figure indicates that all the women, except one (S9), increased their saving capacity. Respondent S9 explained that her ability to save varied, but that it had decreased due to the increase in food expenditure. Previously she was able to manage with her harvest and have enough for petty trade. The unpredictable rain season has changed this.

Figure 6.2: Savings before and after joining WFPG



Source: Primary data

Livelihood Diversification

There are other financial factors that influence the women's adaptive capacity besides fish processing. Diversifying livelihoods is recognised as an effective strategy for rural poor to decrease their vulnerability towards environmental or economic shocks (Simtowe 2010:204). Table 6.2 displays the WFPG members' livelihood strategies by listing their main source of income and secondary sources of income. The husbands income is also listen, though data was not collected on their alternative income generating activities. The table illustrates that all but two husbands (S9, S12) rely on natural resources for their income. Five of the women's husbands work in the fish sector and three are farmers. This is highly problematic and significantly reduces a household's adaptive capacity. This is because households with a greater diversity of livelihood assets are likely to be better equipped to respond to stress, given their ability to substitute between their sources of income (Nelson et al.2009b:3). For example, if both husband and wife work in the fish sector and the lake dries up the income of both partners could collapse simultaneously. The chances for farmers to succeed if the lake dries are also low, as a dry lake indicates abnormally low levels of precipitation. The two women (K4, K5) who have husbands that are employed in the non-natural resource sector,

will theoretically have a higher ability to respond to natural hazards as they have a source of income that is resilient towards climate change.[12] Further, table 6.2 indicates that eight out of eighteen women rely on *ganyu* during economic difficulties. This is a way of diversifying income, but *ganyu* cannot be regarded as a reliable and consistent source of income as labour is often hired for a period of day or weeks (Simtowe 2010:207). It may nevertheless imply that the women might get by during a recession with their savings in addition to *ganyu* and those who have, alternative income generating activities.

Table 6.2: Livelihood diversification

	Wife		**Husband**
	Main source of income	**Other sources of income**	**Main source of income**
K1	Fish processing	Ganyu	Fish sector
K2	Fish processing	Ganyu	Farmer
K3	Fish processing		Fish sector
K4 (separated)	Fish processing	Ganyu, beer brewing	N/A
K5	Fish processing	Building boats	Fish sector
K6 (widow)	Fish processing	Ganyu	N/A
S7	Fish processing		Farmer
S8	Fish processing	Ganyu	Fish sector
S9	Fish processing		Non-NR based
S10 (widow)	Fish processing		N/A
S11	Fish processing		Fish sector
S12	Fish processing		Non-NR based
T13 (divorced)	Fish processing		N/A
T14	Fish processing		Farmer
T15 (widow)	Fish processing	Ganyu	N/A
T16 (separated)	Fish processing		N/A
T17 (widow)	Fish processing	Ganyu	N/A
T18 (separated)	Fish processing	Ganyu	N/A

Source: Primary data

Overall the findings indicate that the women's income base may be regarded as weak and highly vulnerable to climatic changes due to their dependence on natural resources for income and their low diversification of incomes. It is nevertheless evident that the project has significantly increased the women's income and savings, or in other words financial capital. This will make them less vulnerable to changes as they can convert their financial capital to consumptions or other assets needed in order to cope or adapt.

[12] It is unknown how the boat industry is affected by the lake drying up, but it can be assumed that also this sector will be affected through the economic recession that the basin face when the lake dries.

Social Capital

Bebbington (1999 in Adger 2003:391) has argued that social capital brings with it a capability to access resources and hence to enhance the security of livelihoods and well being. On the basis of this Adger (2003:387) argues that social capital is an important asset in enhancing the ability of individuals and communities to adapt to climate change. Assessing social capital in the Lake Chilwa Basin and amongst the women may therefore give valuable insight into their adaptive capacity. The women´s social capital will be assessed by focusing on bridging and networking social capital, which is presented in chapter three. The study will not attempt to measure social capital, but to shed light on the social capital that is already within the community, how LCBCCAP may have enhanced it and how it contributes towards enhancing adaptive capacity.

Bonding Social Capital

Adger (2003:392) argues that "social capital relations that are generated and maintained for non-economic purposes are often a necessary component of coping with extremes in weather and other hazards and their impacts". According to Nagoli (2010:10) people living in the Lake Chilwa Basin have a high informal social network at the village level, which is equivalent to what Adger (2003) calls bonding social capital. The study found that people in a community have a relationship of reciprocity and trust where resources are commonly shared during difficult times. This finding is in line with how the WFPG members described their communities. Fourteen out of seventeen women expressed that their community works together during difficult times, especially during funerals and sickness. Food is commonly shared if someone is in need and if it is necessary people lend each other money.

The empirical findings suggest two ways in which LCBCCAP increased the women's bonding social capital. First, the women's social capital increased when they became active members of the WFPG. Prior to the project, the women had individual businesses. By working together the women have gained new contacts that are valuable not only for business and social purposes, but also in times of need. According to the women, the benefits of working in a group are many, and include the support they give each other through advice, sharing knowledge on business and marketing, and being able to borrow capital from other group members. Due to the lack of access to bank loans, community members play an important role as money lenders and social capital plays a crucial part, as trust between the partners is necessary in such circumstances. Even though the sums of money the women lend

each other are small, it may be enough to get by or cope during stressful times. Hence, their enlarged network and their increased social capital may become an important asset for coping with the impacts of environmental hazards or climate change (Adger 2003:396). Second, the women experienced that people from the communities in which they live admire and respect them because of their work and see them as successful, independent business women. Five of the women (K2, K5, S9, T14, T16) specifically said that they are viewed as active community members. In other words, their involvement in WFPG strengthens the women's position and network within the community.

While social capital is often regarded as something positive it may also be negative. Because social capital is about accessing resources, some might find that the relationship of reciprocity is skewed (Woolcock and Narayan 2000:231). Because the women are financially well off in their communities, people come to them for help. This is what one of the respondents (K2) stated when asked about community members helping each other out. According to her, members from the community do help each other, but she, having resources, is the one helping, whereas people are not able to help her in return.

The findings indicate that the women and the community have high bonding social capital. However, bonding ties are most effective or useful when a natural hazard has already occurred. After a natural hazard has occurred, resources are shared to ensure that everyone gets by. Pelling and High (2005:310) state that "strong bonding ties are associated more with survival than development and are often observed in recovery from natural disaster and conflict". It is therefore argued that bonding ties may not be strong enough to allow communities to prepare for natural disasters or develop adaptation strategies that will allow the community to successfully deal with natural hazards when they occur.

Networking Social Capital

According to Adger (2003:396) networked social capital, referring to vertical relationships, may play an important role in preparing and adapting to future events of natural hazards or climate change. This is because institutions and organisations have more resources and a higher ability to identify strategies that may enhance a community's adaptive capacity prior to an event. The argument for the importance of linking the community to institutions, organisations or the state lies within 'the synergy view' of social capital, also known as state-society synergy (Woodlock and Narayan 2000:235). The main idea of state-society synergy

is formulated by Peter Evans (1996) who argues that "active government and mobilized communities can enhance each other's development efforts" (Evans 1996:1119). In relation to climate change adaptation, Adger (2003:396) claims that communities themselves have the capability to adapt, but that there are certain services or goods that can only be provided by the state or through co-management. In order for adaptation strategies to be effective, local considerations and needs have to be incorporated which can be accomplished through encouraging participation of local communities in decision-making. The WFPG-project is a result of collaboration between communities and LCBCCAP, which will be addressed in the next chapter. The 'fruits' of networking social capital is therefore already harvested by the WFPG members as they are participating in an adaptation project.

Further, in the programmes funding proposal it is stated that "the project will link vertical (communities, NGOs, ministries) and horizontal levels (fishers, farmers, traders, bird-hunters) into design of adaptation strategies) (LEAD et al. 2009:10). As they have successfully managed to do so, the women automatically increases their networking social capital by joining the WFPG as they become connected to the LCBCCAP network including LEAD, WFC, FRIM and other stakeholders such as the Beach Village Committees and Department of Fisheries.[13] As a result of participating in the project, the women were also exposed to the media. The women from Swang'oma WFPG spoke energetically about the trip to Zomba and the University of Malawi, where they participated on the Worlds Water Day by presenting their work. The event was televised, an enriching experiencing for the WFPG members.

According to Adger (2003:393) and Woodlock and Narayan (2000:227) it is the combination of bonding and networking social capital that allows communities to confront vulnerability and poverty, to resolve disputes and to take advantage of new opportunities. The findings indicate that prior to joining the WFPG the women´s bonding social capital was high and it was further increased by being a member of the WFPG. The women's networking capital prior to the participating in the WFPG was not recorded, but joining the WFPG had a positive effect on their networking social capital and the total amount of the WFPG members' social capital.

[13] Because of the distance from the WFC office to the WFPG, but also to enhance sustainability when the programme ends, WFC works with the local government and community based organisations in the communities with WFPG. Their job is to assist the groups if problems or issues evolve and to bring the issues forward to WFC if necessary. They are the bridge between the women and the WFC staff and they are involved with the women on a weekly basis.

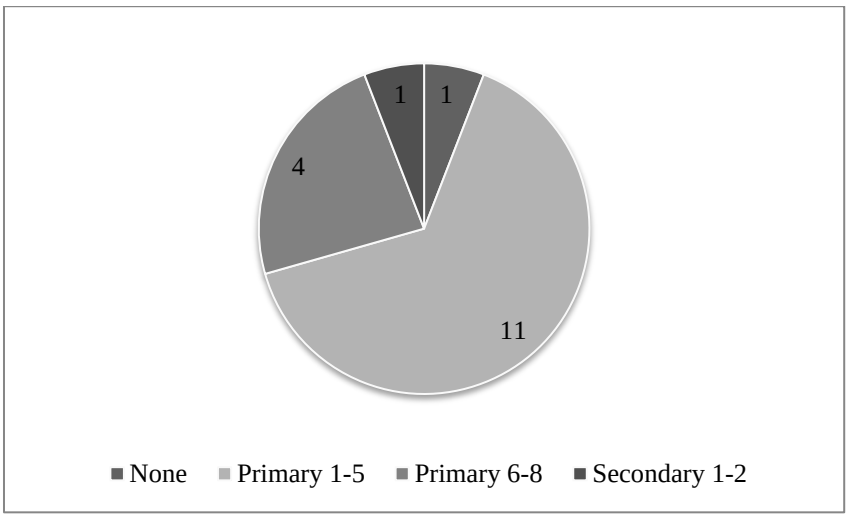
Human Capital

Human capital refers to the labour available to the household: its education, skills and health (Ellis 2000:33). It is enhanced through education, training or through the skills acquired in an occupation. According to Nagoli (2010:9) the basin has a low level of human capital, which affects the peoples' capacity to diversify their livelihood strategies, and hence their adaptive capacity (Nelson et al. 2009a:20).

Education Level

LCBCCAP does not influence the women's formal education level, but their education level is highly relevant for the WFPG members' adaptive capacity..

Figure 6.4: Education level of WFPG members



Source: Primary data

Education influences the ability to make reasonable choices, diversify their livelihoods and to plan for future events. Figure 6.3 illustrates the education level of the WFPG members. All but one respondent (K2) have entered primary school. Education level is nevertheless low as only four of seventeen women enrolled in grade six. The WFPG member's education level is however a reflection of the national statistic that indicate that the median year of schooling for females in rural areas is 3.4 years, compared to 5.1 for males (GoM 2010:vii).

Occupation and Training

Prior to participating in the WFPG, all but one respondent (K5) worked with fish processing. Respondent K5 worked in her own tea-room.[14] LCBCCAP's influence on the women's occupation is therefore not on what they do, but how they do it. As presented in chapter five, LCBCCAP has given the WFPG members training in business management, fish processing, group dynamics, gender and climate change.

Business management training

Business management training has increased the women's business skills substantially. The women said that the training has made them capable of running a business by themselves. Respondent T14 expressed that "Previously we did not know how to calculate business profits so we did not know if we were losing or earning money". Respondent S9 explained that the business training has improved her planning, making her more efficient and respondent K5 emphasise that business training has increased her capability of managing her money: "Because of business training I now am better at managing my income. I put all my money into the village bank" (K5). The general picture emphasised by the women is represented by K6 who said "The project has turned me into a business woman".

Fish processing training

Fish processing training has taught the women how to use the solar fish driers, new improved smoking kilns and how and why to package fish. The training is crucial for the women to be able to produce a product of high quality, necessary if the product is to be sold on the formal market. It has also thought them about the correlation between quality and price.

Gender training

An important lesson from gender training was acknowledged by respondent S7 "Before I thought that business was only for men; now I know that I can also do it". Botha also explained that smoking fish is traditionally a man's job, but the gender training ensured the women that they could also smoke fish. Overall the women's understanding of their own capabilities has increased. The women state that they have realised that they are capable of running a business and provide an income and food for the household. In the household the women are viewed as an asset and are respected as they provide on equal terms with the husband. Eight out of eighteen women are the only bread-winner in the household being

[14] A tea-room is a small cafè.

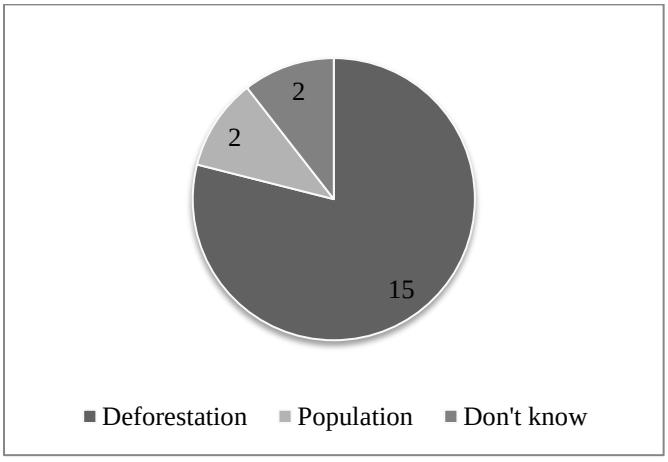
either separated, divorced or widowed. These women are especially satisfied about being able to provide for their families independently. Participating in the project has also affected how the community view the women. Because the project is successful, people admire and respect them. They are viewed as independent and active community members.

Climate change training

LCBCCAP provide the women with training on climate change in order for the women to better understand the changes that they are facing, future scenarios and how the project and their work is related to climate change adaptation. In order to get an understanding of the WFPG member's knowledge of climate change the women were asked why they think the climate is changing.

Figure 6.4 illustrates that the women have a low level of knowledge on climate change. That being said, deforestation is one of the key contributors to CO_2 emission globally and in Malawi. Deforestation contributes about 20 to 25 per cent to the global annual atmospheric emissions of CO_2 which causes global warming (UNEP2007:49). In Malawi the most significant sector of emissions are agriculture, forestry and other land use which contributes 95 per cent of total emissions. The energy sector is the second largest contributor with 3.4 per cent. Burning of firewood is a key contributor in this sector (EAD 2010: 219). Deforestation releases carbon stored in the trees as well as the soil and depletes its potential as a CO_2 sink (UNEP 2007:49). In addition, deforestation also contributes towards changing the microclimate or the local climate. When trees are removed, access to shade decreases and the temperature will automatically feel higher.

Figure 6.4: Causes of climate change



Source: Primary data

The study did not go into depth about what the members were taught during training, but according to Phalira, the training mainly focuses on deforestation. This is because it is a concept that is understood as well as an issue that rural people are capable of responding to in terms of mitigation. The women are able to understand how their practice of cutting down trees contributes towards deforestation and consequently changes in the local climate and they are also able to plant new trees. However, only one of the respondents (T15) mentioned that she had planted trees. She believes that this will bring more rain in the future. Her statement indicates the general low understanding of the causes of climate change and LCBCCAP may therefore consider revising their training. It must nevertheless be stated that climate change and deforestation is a topic that is discussed in the media. The women explained that their knowledge on climate change came from the media (radio), community meetings and extension workers. What canal of information is most influential to them is unknown.

Summarising the findings from human capital, it is evident that LCBCCAP and the women's involvement in the WFPG has increased their human capital, especially through training as it has increased their skills and knowledge base. However, with the single focus on fish processing, LCBCCAP does not encourage diversification of livelihoods, which is recognised as an important component of adaptation, especially for rural households depending on natural resources. It can nevertheless be argued that with improved business skills, the women have a better chance of moving into other sectors. Overall, the findings indicate that the women's total human capital should still be regarded as weak.

Natural Capital

According to Ellis (2000:32) "Natural capital compromises the land, water and biological resources that are utilised by people to generate means of survival". Natural capital increases when natural resources are brought under control, making the resource productive to the society (Ellis 2000:32). The Lake Chilwa Basin is rich on natural resources such as the lake and its wetland, forest and arable land, indicating that the women have a high natural capital (Njaya et al. 2011:16).

These resources are the main source of livelihood for the people living in the basin (Nagoli 2010:12). The women's livelihood is highly dependent on the lake and its fish stock, in addition to the forest where the women collect firewood for smoking fish. The land is also important due to subsistence farming, but as mentioned in chapter five, the women's

dependency on subsistence farming is challenged by the low production in the past years due to poor rain seasons. Lake Chilwa has a positive effect on the women's natural capital, as it is one of the most productive and resilient lakes in Malawi (Njaya et al. 2011:15). However, their over-dependency on one natural resource increases their vulnerability towards climate change (Adger et al. 2007:720). The lake itself is vulnerable to changes in the climate such as low precipitation and higher temperatures, which can dry up the lake temporarily (Njaya et al. 2011:18). The last time the lake dried up completely was in 1995/1996. The women's experiences are listed in box 6.1. The drying of the lake is regarded as a natural cycle and the people living in the area appear to be well adapted to the cycles (Njaya et al. 2011:16).Moss (1992 in Njaya et al. 2011:16). The findings nevertheless indicate the communities struggled when Lake Chilwa dried in 1995/1996. In order to survive people engaged in alternative income generating actives or migrated for to find employment and food. While this indicates that they were able to cope, it does not indicate that they are well adapted to the circumstances as their reliance on the fish and farming sector still makes them just as vulnerable to future events.

Box 6.1: The drying of Lake Chilwa 1995/1996

The last incident of the lake completely drying up was in 1995/1996. Looking back at how communities and individuals were able to cope at that time gives valuable insight into people's ability to adapt to present and future climate changes.

Nine out of the eighteen women remember the incident well while the rest were either too young or not living in the area. The women that remember the incident were asked about how they responded to the incident. The responses are divided between the three groups as the areas were affected differently.

Kachulu
- Not possible to rely on the fish sector
- They had to migrate and get involved in *ganyu*
- Buy food from Phalombe to sell in Kachulu
- Cultivate vegetables were the lake used to be
- Processed maize flour instead of processing fish

Swang'oma
- Not possible to fish during that time
- They had to fetch water from a distance of 6 km
- Migrate to Mozambique or other cities for *ganyu*
- Due to lack of food they ate a local plant growing in the lake
- Travel to Mozambique to buy food which took three days

Tadala
- They had to fetch water from a distance
- People migrated to distant places for *ganyu*
- People relocated to places where it was still possible to grow crops in order to purchase food from them.

Source: Primary data

Joining the WFPG does not increase the women's natural capital, but it does ensure that the resources' values increase through the solar fish driers and packaging of the fish. Overall, the WFPG members' natural capital remains high, but is vulnerable to and threatened by climate change.

Physical Capital

Physical capital refers to capital created by economic production processes such as buildings, irrigation, roads, tools, machines. It is important for the women's adaptive capacity as it allows them to "create a flow of outputs into the future" (Ellis 2000:32-33). The rural areas in Lake Chilwa Basin are generally low on physical capital (Nagoli 2010:19), but LCBCCAP enhances it to some extent it by providing them with solar fish driers and smoking kilns. Overall, the increase in physical capital contributes positively to their adaptive capacity, as their increased income, by utilising the physical capital, can be transformed to assets needed when coping with or adapting to climate change.

Total Adaptive Capacity

Assessing the WFPG members' financial, social, human, natural and physical capital gives valuable insight into their adaptive capacity. By comparing the level of each asset before and after joining the WFPG an understanding of LCBCCAP influence on the members' adaptive capacity. The assessment of the capital assets found that the WFPG-project has had a positive effect on all capital assets, on some more than others.

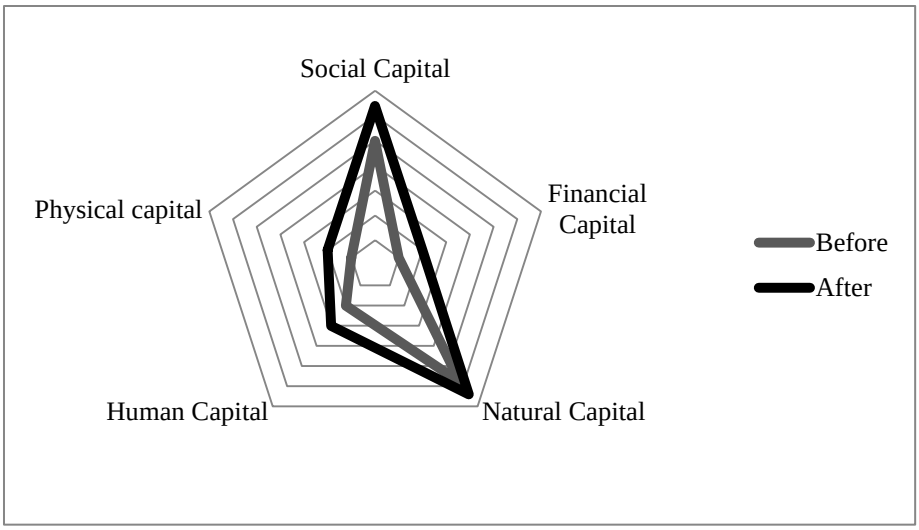
To summarise, financial capital, through income and savings, was substantially increased, but the women group members' income level is still regarded as low. Financial capital is often regarded as the most important asset in regard to adaptive capacity (Nyong et al. 2007:792). Social capital, both bonding and networking social capital has increased. Bonding social capital was already regarded as high, but the women's involvement in the WFPG has had a significant effect on their vertical networks, connecting them to international and governmental organisations and structures. Human capital was regarded as low, but has been increased through training provided by LCBCCAP. Business training was highlighted by the WFPG members as the most beneficial training. It cannot be argued that women's natural capital has increased, but LCBCCAP has increased the financial productivity of the natural resources as the women are able to get a higher price for their product. The physical capital

has also increased. Prior to becoming a member of the WFPG, the women used simple tools or no tools to dry fish. Their access to the new solar fish drier has significantly increased their income.

The level of which each capital has increased differs and so does the importance of each individual capital to the women's adaptive capacity. They all have different roles that enable the women to prepare or adapt to climate change. Financial capital is often regarded as the most important indicator of adaptive capacity (Nyong et al.792), but in recent years scholars have argued that social capital will play a significant role for rural poor who depend on natural resources (Adger 2003, Pelling and High 2005). The women emphasise that the community plays an important role in coping as they share food and assist financially when necessary. However, the WFPG members continuously emphasised how important the extra income was as it allowed them to save and purchase food. Financial capital should therefore be regarded as an important indicator for adaptive capacity. The savings will be important in case of emergencies and the fact that the women are purchasing food is a sign of the women adapting to the climatic changes as they no longer can rely solely on their subsistence farming. Smit and Wandel (2006) nevertheless state that individual determinants of adaptive capacity cannot be isolated from each other. They explain "the presence of a strong kinship network may increase adaptive capacity by allowing greater access to economic resources, increasing managerial ability, supplying supplementary labor and buffering psychological stress" (Smit and Wandel (2006:288). In other words, social capital may influence financial and human capital. It is therefore not possible to conclude which asset that has the biggest effect on the WFPG members' adaptive capacity. It is however possible to draw a conclusion on LCBCCAP effect on the women's total adaptive capacity by utilising Carney's pentagon diagram.

Carney (1988 in Ellis 2000:49) developed a way to compare asset status between social groups by plotting in the status on a pentagon. Even though the pentagon was designed to compare social groups, it is also useful for visually explaining the asset status of the WFPG members before and after joining the groups. The centre of the pentagon represents zero assets and the tip of each corner represents a high level of the given asset in the same corner. The overall asset status of the WFPGs is represented by the central area bounded by the joining lines. It must be noted that the pentagon is only a drawing to illustrate the increase in adaptive capacity and not to quantify the increase of assets.

Figure 6.5: Illustration of adaptive capacity before and after joining WFPGs.



Source: (Carney 1998 in Ellis 2000:49 modified by author)

The pentagon clearly indicates that the women´s adaptive capacity has increased after joining the WFPG. It can therefore be argued that the LCBCCAP project has successfully reached their goal of increasing adaptive capacity in households in the Lake Chilwa Basin through the WFPG.

Adaptive Capacity and the Women's Vulnerability towards Climate Change

The finding indicates that LCBCCAP has enhanced the WFPG member's adaptive capacity. This is an excellent achievement and an important step towards reducing the women's vulnerability towards climate change. However, the findings reveal certain issues that are concerning. LCBCCAP claim that they will work towards diversifying livelihood strategies in the basin,

> Tactical adaptations will concentrate on improving and diversifying livelihoods and building capacity for innovation and entrepreneurship. (LEAD et al. 2009:13).

> It is recognized that resilience to climate change involves household's diversifying their livelihood strategies to have options for managing drought, floods, and temperature increases. Thus, in communities throughout the Basin, the project will work to identify ways in which to diversify and enhance their livelihoods, increase productivity of ecosystems and rural incomes, and reduce vulnerability to economic and environmental shocks (LEAD et al. 2009:15).

The findings nevertheless indicate that the women have not diversified their livelihood strategies. The WFPG members are still working in the same sector as before joining the

project and they have not engaged in any other income generating activities, except two women. The findings also indicate that the women's husbands also rely on natural resources for their income. Being involved in a different sector, such as farming may indicate a small level of diversification, but the agricultural sector is regarded as the most vulnerable sector to climate change in Africa (Boko et al. 2007:435). The business training and overall participation in the project may have had a positive impact on their entrepreneurship and ability to diversify their income. This enhances their ability to start new businesses and may lead them to do so at a later point. The interviews nevertheless indicate that the women have few plans of diversifying their livelihood strategies. When asking the women about changes they have made due to the changing climate, all of the women explained that they had done nothing except joining the WFPG (17/18 worked as fish processors before joining the WFPG). They argued that they focus on fish processing since it provides a good income. Only one woman (K3) indicated that she want to introduce changes. Respondent K3 explained that she wanted to start cultivating rice in addition to maize, hoping that it would be sufficient to provide the family with food throughout the year. This indicates that they are not planning to diversify their income and consequently their income is highly vulnerable to natural hazards and climate change. It is therefore argued that LCBCCAP has not diversified the WFPG member's livelihood strategies, which could have further increased their adaptive capacity and reduced their vulnerability towards climate change.

Despite increasing the women's adaptive capacity, it may be argued that the women should still be regarded as extremely vulnerable to climate change. The women´s reliance on natural resources is a concern as they are threatened by the changes in the climate. As explained in chapter two and five, the water level of the lake is directly linked to the level of annual precipitation and the WFC and WFPG members are worried that the Lake Chilwa will dry up this or the following year if the district only receives the same amount of rain as it has the previous years. If this happens the women's livelihood will disappear until the lake refills, which usually takes about two years (Njaya et al. 2011:21). The findings from box 6.1 indicate that in order to get by, the people in the basin engage in different sectors. The business training and their increased awareness of their own capabilities may have enhanced the women's ability to venture into other sectors or establish another business during the time it takes for the lake to refill.

It is however a paradox that the LCBCCAP is enhancing the women's capacities within a sector that is threatened by climate change – the event the programme is trying to prepare the

communities in the basin for. This issue does not change the fact that the programme and the WFPG has significantly increased the women's income and overall adaptive capacity, but is it enough to argue that the women's vulnerability to climate change has been reduced significantly?

Chapter Seven:
Utilising Local Knowledge for Climate Change Adaptation

According to Nyong et al. (2007) very little attention has been paid to incorporating local knowledge into climate change adaptation projects. The Lake Chilwa Climate Change Adaptation Programme (LCBCCAP) however, argues for the importance of including the local people in design and implementation of the project. How they do it and how it affects the programme and its beneficiaries is the topic of this chapter. Their experiences will therefore be assessed in order to achieve the main objective of the study, which is to understand how local knowledge can be utilised to enhance climate change adaptation programmes. In order to reach this objective the chapter will answer to the third research question, which asks - To what extent has LCBCCAP utilised local knowledge and how does it affect the programme and its beneficiaries*?* How LCBCCAP utilises local knowledge will be analysed by reviewing the programme document and interviews held with staff and stakeholders of the programme and the members of the Women Fish Processing Groups (WFPG). By focusing on these issues the hypothesis that local knowledge enhances climate change adaptation programmes will be questioned and the empirical findings will be analysed in the light of the literature on local knowledge in order to draw a conclusion.

LCBCCAP and Local Knowledge

In LCBCCAP reports, local knowledge is presented as one of the key factors to the programme. There is, however, no clear policy about utilising local knowledge and the term is actually never used explicitly. It is, nevertheless, implicit that local knowledge is utilised through participation of the local communities. Their commitment to include and involve the local communities throughout different stages in the project is clearly permeated throughout the programmes documents. Participation is indeed identified as a key element for success as LCBCCAP recognises that

> Efforts will focus on improving the participation of the poor in decision-making and management of their resources…Participatory research will ascertain local perceptions of climate change and broader ecological and socio-economic change. We will solicit local priorities for enhancing their adaptive capacity to adverse events. Understanding local perceptions is crucial for determining the degree of interest in adopting planned adaptive strategies (LEAD et al. 2009:13).

> Planned adaptation must be participatory and inclusive process whereby stakeholders identify strategies and are engaged in the implementation and monitoring to help build their capacity to take up opportunities for development and to reduce their vulnerability to threats as they rise (LEAD et al. 2009:3).

These statements indicate that LCBCCAP claim to use local knowledge by facilitating local participation at all stages of the project; design, implementation and monitoring. Claiming to use local knowledge does however not imply that the participatory process is successfully incorporated into the programme. Participation is a buzzword and it has become important for legitimising projects and to attract funding (Silva and Kepe 2010:52). But there are reasons to question if all who claim to use participatory approaches actually do (Chambers 1994:959). It is a time-consuming process to fully incorporate and carry out participatory approaches, and NGOs, and other development agencies often lack time. The LCBCCAP is initially a five-year programme, which is a limited time to design, implement and ensure sustainability for such an extensive programme. LCBCCAP Programme Manager, Welton Phalira, therefore acknowledged that though they want to utilise local knowledge and participatory approaches, time does not always allow it.

Nevertheless, the interviews and discussions with the Phalira brought clarity to how LCBCCAP use local knowledge. According to Phalira, the programme collaborated with the local communities prior to launching the project. The feedbacks that arrived from consulting the local communities were utilised when writing the funding proposal to ensure that the programme was adapted to their needs. After funding from the Royal Norwegian Embassy in Malawi was granted, the collaboration continued. In the Implementation strategy for 2011 it is stated that

> This project is integrating participatory research with participatory management process that brings together multiple stakeholders across sectors. Participation of the communities was sought in defining hotspots and choosing adaptive strategies to test as quick win (LEAD 2011:8).

This statement reflects the participatory process of the whole programme. The main focus of the study is, however, to examine how local knowledge has been utilised for the WFPG-project specifically and what kind of impact it has on the programme and its beneficiaries.

WFPG and Local Knowledge

There is no individual document on the WFPG-project and how local knowledge has been utilised in design and implementation. The findings are therefore based on interviews with Leadership for Environment and Development (LEAD), WorldFish Centre (WFC), Department of Fisheries (DoF) and the WFPG members. It must however be noted that it was challenging to collect data about local knowledge from both the DoF and the WFPG members. The concept of local knowledge is vague and the DoF respondents did not grasp the questions. Further, it can be difficult to be aware of one's own knowledge so the women were asked about participation instead of local knowledge. More time might have made it possible to discuss local knowledge with the women. However, because the focus was shifted towards participation, this may have affected the overall findings of the study. The majority of the data concerning local knowledge and participation is nevertheless from LEAD and WFC.

Participatory Processes

According to Phalira, prior to implementing any project, the local communities were consulted through community meetings. A discussion was facilitated about the communities experience with climate change, how they were affected and what issues they thought needed to be addressed in order for them to reduce their vulnerability to climate change. They were then introduced to several adaptation strategies that LCBCCAP considered to be appropriate. According to LEAD et al. (2009:15) and confirmed by Phalira, all projects are based on existing adaptation strategies that have proven to be successful. The solar fish driers are influenced by a similar project implemented in Sri Lanka by the UK based NGO 'Practical Action' and the idea of the smoking kilns came from another adaptation project. Despite being foreign in origin, the new methods are rich on local content. As explained in chapter two, the new methods do not drastically differ from the traditional method of processing fish. The main difference in the way the WFPG process fish is not how they do it, but the tools they utilise. Chrispine Botha, Agribusiness Officer at WFC and involved with the WFPGs, therefore argues that the project is based on the local knowledge of processing fish. LCBCCAP simply introduces new methods to improve the fish production.

In other words, it was already decided that the project was to be implemented in the area. However, this does not differ from how Phalira presented the general process for LCBCCAP. He explained that they work with the local structures and consult the Area Development

Committee (ADC) and Village Development Committee (VDC), which is a representative body from the village or a group of villages (LEAD 2012:62) and other Community Based Organisations (CBOs), such as the Beach Village Committees (BVC). Botha, explained that for the meetings in Phalombe and Kachulu there was a wide range of people who represent different interests. The meeting included VDC representatives, ADC representatives, Community natural Resource Management Committee representatives (including fishers, fish traders, fish processors, boat makers and other entrepreneurs), extension works, lead farmers and local leaders. It was therefore the representative bodies that voted for the WFPG in Swang'oma and Manguluni. The argument is that since they are representative bodies, they should have sufficient insight into what adaptive strategies would benefit the community. Despite the fact that not all the women were present or involved in choosing the project, the women's opinions and their suggestions are valued and respected and even help shape the project. The next statements give three illustrative examples of the women's participation in forming the WFPG-project.

> The women raised serious concerns about the use of paper in the driers as they feared goats and kids would damage the facilities. They suggested the use of chicken wire around the paper at the bottom of the drier to prevent animals from damaging the driers. This was an amazing improvement to the technology. (Botha 2012)

> The project involved the women in the trials of the drying times for the Matemba.[15] The women took charge of mobilization of samples, taking readings of temperatures in the driers and monitored the length of drying time. The project shared and discussed the results with the women and interpretation of results was made collaboratively (Botha 2012).

> The project then engaged them in a SWOT analysis of the available fish value additions on the market. Collaboratively, we designed how to capitalize on the weaknesses of the available fish products and utilize the opportunities available. A private sector enterprise was engaged to do the design of the packaging based on what the women and other stake holders had put together. The printed samples were shared with all stake holders and final inputs were incorporated before printing the first ever packaging materials for the women's Matemba. (Botha 2012)

Without observing the participatory processes over an extended period it is challenging to conclude how participatory the processes are and to what extent the women in the WFPG

[15] Matemba is one of the major fish species in Lake Chilwa (Chiwaula and Chaweza 2010:16) and is the type of fish the WFPG process.

have participated in the different stages of the project. However, through the findings it is possible to draw some conclusions on the women's involvement in the project and how local knowledge has enhanced the WFPG. First of all, the WFPG-project itself is a sign of LCBCCAP understanding of the importance of utilising local knowledge and practices. The project is based on the traditional way of processing fish, but LCBCCAP introduces two new instruments that will improve their production. The solar driers and improved smoking kilns do however not change the way the women process fish. In other words, they have improved the framework of fish processing for the members of the WFPG. Second, it has been stated that LCBCCAP utilises local knowledge through participatory means. LCBCCAP conduct participatory research and encourage participation through all stages of the programme. The local community participated in a community meeting where adaptation strategies were selected by the individual communities. However, only some of the WFPG members were part of this process. The women who are now members of the WFPG were either selected to be part of a group or asked to form a group by themselves. Since becoming a member, the WFPG have been participating in shaping the design of the solar driers, participated in analysis of the fish value chain and helped developed the process of producing a product that is of high enough quality to be sold at the formal markets. Further, Botha confirms that there is an 'open door-policy' and the WFPG can contact the partners from the DoF or call directly to the WFC office if they have any inquires. The WFPG members expressed that they are satisfied with their participatory roles. They expressed that the communication and collaboration between them and LCBCCAP is good and that LCBCCAP values their opinions and participation.

Benefits and Challenges

LCBCCAP use of local knowledge has resulted in a successful project that has enhanced the WFPG members' adaptive capacity as described in chapter six. In order to gain a better understanding of the affect local knowledge has on an adaptation programme, the benefits and challenges of utilising local knowledge will be presented. The benefits of utilising local knowledge, for both the programme and the beneficiaries are listed in box 7.1. The benefits and challenges will further be discussed in the next section that discusses how local knowledge can be utilised for climate change adaptation.

Box 7.1: Benefits and challenges identified by LCBCCAP for utilising local knowledge

Benefits

1. **Increased awareness of local development issues**
   The communities have the best knowledge about challenges they face, both socio-economic issues and how they are affected by climate change.
2. **Increase knowledge about the local environment**
   The communities have the best knowledge about their local area. They can provide a historical perspective of the climate in the area, they have valuable insight into their eco-systems and eco-processed and know where the valuable resources are. They know what strategies that have been used before, they know what worked and what did not work.
3. **Tailor made adaptation programme**
   By consulting and involving the local population in project design, the projects are developed to answer to the specific problems and needs of the area. There is therefore a greater chance of a successful project that will answer to the need of the community.
4. **Increased sustainability**
   When projects are rich in local content and are an outcome of collaboration between community and organisation, the community gains ownership in the project which increases the sustainability.
5. **Increased efficiency**
   When the community participate and the local structures are utilised when implementing projects, efficiency increases as they know the area.
6. **Cost-effective**
   Because projects that are based on local knowledge are tailor made for the specific situation and because the community have ownership, there is a greater chance that the project is successful. When implementing foreign ideas there is a greater chance the project will fail and hence money is wasted.
7. **Improves communication and reduces conflicts**
   Utilising local knowledge through participatory means improves communication between the community and organisation which also reduces the chance of misunderstandings and conflicts occurring. This also increases sustainability.
8. **Local empowerment**
   Through participation, communities become empowered. By showing respect for the communities' knowledge and practices the communities become empowered as they understand that their opinions are valuable and necessary for a successful project.

Challenges

1. **Conflicting Knowledge**
   Conflicts between local knowledge and scientific knowledge occur. It is challenging to deal with such situations as it is important to respect the local knowledge and one should not assume that one type of knowledge is superior. An example experienced by LCBCCAP is that some community members believe that climate change is God's punishment for people's sins. LCBCCAP has to respect their believes but is still interested in teaching them about climate change and increase their adaptive capacity. In order to do so, LCBCCAP invited religious leaders and taught them about climate change and asked them if they could relate the scientific knowledge to the religious scripts, which they could. By using the religious scripts to explain climate change, a language is used that the communities respect and understand which makes them more responsive to learning about the scientific understanding of climate change.
2. **Validity of Local knowledge**
   In order for local knowledge to be used, it has to be tested to ensure that it is useful. However, not all knowledge is scientifically valid or sustainable, which again creates a dilemma of how to deal with such situations.

Source: Primary data

The majority of the issues were raised by Phalira and Botha from LCBCCAP as it was challenging to collect data on local knowledge from the WFPG and the DoF. The lists provide a broad spectrum of benefits. LCBCCAP recognises that there are benefits for both the

programme and for the WFPG. The list clearly illustrates that LCBCCAP considers local knowledge as more than an asset to them. This is indeed an important component of local knowledge, it should not only benefit the programme facilitators, but also the beneficiaries (Sillitoe 2006:6). LCBCCAP recognised that while local knowledge improves the programme design (as they can base it on the local context), reduces conflicts and cost and enhances sustainability, not only are they able to implement a project that has good chance to improve the lives of the beneficiaries, they are also contributing towards empowering them by including them in the project processes and by valuing their knowledge. This is indeed one of the arguments for utilising local knowledge (Blaikie et al. 1996:225). While there are numerous advantages for both LCBCCAP and its beneficiaries, there are also several challenges related to utilising local knowledge. The two issues raised by Phalira and Botha concern conflicting knowledge and the validity of local knowledge. The discussion on how these issues relate to utilising local knowledge in climate change adaptation will be addressed in the next section.

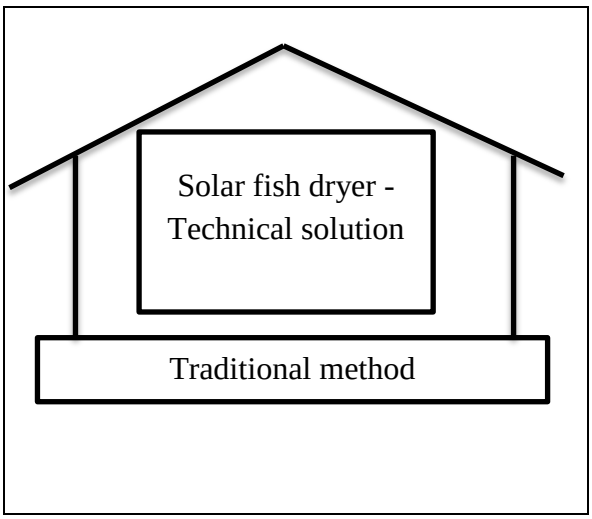
Utilising Local Knowledge to Enhance Climate Change Adaptation

For climate change adaptation to be successful and sustainable, scholars (Adger 2003, Blanco 2006, Nyong et al. 2007) are arguing that local knowledge needs to be incorporated into adaptation strategies. The question is then – how can local knowledge be included in adaptation? This section will critically discuss how LCBCCAP has utilised local knowledge for climate change adaptation and the way forward for the discourse 'local knowledge in climate change'.

The findings indicate the LCBCCAP utilises local knowledge through participatory means. By including the local people in project design and implementation, the WFPG becomes a coproduced project (Bebbington 2002:514). The collaboration between the community and LCBCCAP can be recognised as a key factor to the success of the WFPG. By collaborating together, LCBCCAP and the communities have constructed and implemented a project that is rich on both local content and modern techniques. LCBCCAP utilise adaptation strategies that has proved to work elsewhere and merged these with the information from the local community. The traditional practices of processing fish can be understood as the foundation of the project. By combining the two sets of knowledge systems, LCBCCAP is able to design a project in collaboration with the community that is tailor made for the community's specific

needs. As argued by Nyong et al. (2007:788) local knowledge should not replace scientific knowledge, but they should complement each other to produce "best practices". A best practice is the result of using both local knowledge and modern techniques, which results with a product that is more valuable than either was on its own (Nyong et al. 2007:788). The WFPG can therefore be regarded as a 'best practice', illustrated in figure 7.1.

Figure 7.1: LCBCCAPs 'Best Practice'



Source: Author

According to Phalira, it is not easy to introduce new knowledge or technology into rural communities. They rely on the knowledge their ancestors have passed on in generations and are sceptical of new methods, but only until they have proven to be successful. Phalira therefore recognises that the local knowledge system are not static, people are open to new ideas as long as they remain in control (Briggs 2005:109). Nevertheless, if the new methods are based on local practices, it should arguably be easier to introduce new ideas. This is what Boko et al. (2007) claims when saying that "people are better able to adopt new ideas when these can be seen in the context of existing practices" (Boko et al. 2007:456). Nyong et al. (2007:795) agree as they argue that capacity building should build on the capacities that already exist within a given community.

This is exactly what LCBCCAP has done as all but one woman worked in fish processing before becoming a member of the WFPGs. They already had knowledge about processing fish and were aware of the weaknesses to the traditional practice. This meant that they were open for improving the way they processed fish and welcomed the interventions introduced by LCBCCAP. As explained in chapter two, there is not a major difference between the ways the women process fish now compared to the traditional method. There were therefore no major

challenges when implementing the project. The combination of LCBCCAP utilising the capacities within the community and combing local knowledge with practices that are known to be beneficial can be seen as an important reason to the success of the project.

Local knowledge and adaptation programmes in development countries are a natural match as organisations who introduce adaptation programmes are interested in knowing the historical perspective of the local climate and environment in order to design appropriate adaption programmes. Very often there is a limited data on climate over time in poor countries. Local people's knowledge concerning climate is therefore extremely valuable, as recognised by Phalira and noted in box 7.1 (Nyong et al. 2007:787-788). However, there is a danger that it remains with that. Box 7.1 illustrates that a benefit of utilising local knowledge is also gaining insights into local development issues. This should be regarded as crucial knowledge for adaptation programmes. Not only should adaptation programmes understand the environmental challenges in the area, for example how the climate has changed and if extreme weather events have increased, but socio-economic issues are just as relevant (Sillitoe 2006:6). This is why LCBCCAP focuses on increasing and diversifying incomes. The study illustrates that climate change affects the most fundamental areas in rural poor people's lives in Malawi: food security and employment. Adaptation programmes need to address such issues as they drastically increase vulnerability to climate change. Adaptation programmes should therefore focus on issues beyond the typical adaptation strategies such as environmental resource management and agriculture productivity (Pelling and High 2005:308). Poverty reduction is crucial to reduce vulnerability and enhance adaptive capacity (Boko et al. 2007:452). Detailed knowledge about the local area, livelihood strategies, agricultural practices etc. is therefore crucial information for adaptation programmes. The LCBCCAP case illustrates that in order to make appropriate solutions, it is necessary to have an in-depth contextual understanding of the challenges. This information is best obtained through dialogues with the local communities.

Local knowledge and climate change adaptation is a fairly new discourse and is in the process of evolving. The key findings from how LCBCCAP has utilised local knowledge indicates that the discourse of local knowledge needs to look back in time to the origin of local knowledge in development – to participatory approaches. Participatory approaches emerged as a response to the failure of top-down approaches that had neglected the local people's involvement, knowledge, needs and preferences. The participatory approaches, such as

Chambers Participatory Rural Appraisal (PRA), sought to allow the local people to define social change through their own perspectives. It aimed to empower the local population, not merely enhance growth. This was to be done by partially handing the stick over to them. By involving the local people in analysis, planning and implementation the poor take charge of their own development (Rahnema 1990:200, Chambers 1994:958). The LCBCCAP illustrates that such bottom-up approaches give more sustainable and successful outcomes as the local population has ownership in the projects (Silva and Kepe 2010:34). Local knowledge for climate change adaptation should draw on lessons from participatory approaches to ensure that sustainable projects that empower the local people and successfully prepares or enables them to cope with climate change.

Learning from the Critique of Local Knowledge and Participatory Approaches

It is nevertheless necessary to remain critical and learn from the critique of participatory approaches (Dodman and Mitlin 2011:5-6). As presented in chapter three, the questions of *who* and *whose* are very important for participatory approaches and local knowledge. Silva and Kepe (2010:52) argued that adaptation programmes that require participation may exclude the poorest of the poor due to time and labour constrains. This critique is relevant in relation to LCBCCAP. Initially, only women who were already processing fish were qualified to participate. In addition, the women had to be willing to invest own money in business and be literate, alternatively have someone who could read and write for the. According to Njaya et al. (2011:18) households that engage in the fish sector have higher incomes than those who do not. There are therefore reasons to believe that the poorest in the Lake Chilwa Basin are excluded from the WFPG. It must be noted that the three WFPG are pilot projects. Another fifteen WFPG are in the process of being established (LEAD 2012b:4). Time will show whether these will allow non-fish processers to learn the skills of fish processing through the WFPG.

Briggs and Sharp (2004:666), Briggs (2005:105) and Smith (2010:605) raises a similar question – whose knowledge counts *within* communities? When utilising local knowledge it is important to consider the power relations within the community to ensure that all 'voices' are heard. As noted, there was a wide spectrum of people involved at the community meetings when the WFPG-project was selected. By inviting such a broad spectrum of people there is a higher chance that the majority of voices are heard. It is nevertheless not guaranteed and

LCBCCAP should keep working towards finding ways that ensures that also the poorest of the poorest benefit from their initiatives.

The debate on whose knowledge that counts does however go beyond the community. When utilising local knowledge it is important to respect the perspectives and opinions that are expressed by the local people. However, what happens when the local knowledge challenges western or scientific knowledge? Whose knowledge counts? Briggs and Sharp (2004:667) argue that "indigenous knowledge is now being allowed to offer a fundamental challenge to development, just the opportunity to offer a few technical solutions, place-specific tweakings". This is a problematic that LCBCCAP also has had to deal with. Phalira acknowledged that it was challenging when LCBCCAP was faced with such circumstances where local people's knowledge conflicted with scientific knowledge. The example of God and climate change presented in box 7.1 illustrates such a circumstance. When LCBCCAP facilitate discussions about the causes of climate change, community members often claim that climate change is a punishment from God for peoples' sins. An article in Nation, a Malaiwan newspaper, explains,

> In most African communities, dry spells are spiritual issues. People do not regard them as a problem caused by the changing climate but the expression of the wrath of gods. Among the Ngonde in Karonga, when a dry spell falls, people go to the shrine to plead forgiveness from the gods (Nyondo 2012:8-9)

Phalira also explained that this is a common belief in the communities, but this study did not have similar findings. LCBCCAP was however able to deal with the matter by respecting the local's believes and facilitating collaboration between LCBCCAP and the religious communities in the basin. That way the religious leaders could teach the communities about the scientific causes of climate change, but through a means that they respect. For climate change adaptation, scientific knowledge plays an important part as it provides evidence. However, if the local people do not regard scientific knowledge as a trustworthy or significant, local knowledge may play a crucial part in educating them. As acknowledge by Phalira, "it is important to speak their 'language'". The debate about local and scientific knowledge will continue to challenge development, and organisations utilising local knowledge must be prepared to have their views challenged by 'local knowledge' (Briggs and Sharp 2004:668).

At last, the LCBCCAP illustrates an important issue that has been in the centre of the discussion on utilising local knowledge in development, and now for climate change adaptation – The question of generalisation. Briggs and Sharp (2004), Briggs (2005) and Sillitoe (2006) argue that local knowledge can and should not be generalised. According to Briggs (2005:109) it is "the local embeddedness of indigenous knowledge that imbues it with relevance, applicability and even power". The question than is how can local knowledge be used as a tool if it cannot be generalised and taken out of its context? This study argues that it is not the local knowledge per se that should be generalised or mainstreamed into climate change adaptation programmes. Mainstreaming decontextualized local knowledge into development or climate change adaptation programmes will probably give the same results as other top-down approaches as there is not much of a difference between a top-down approach and forcing a foreign 'local knowledge' into another area. The main argument for using local knowledge is that it should be *local*. It is therefore the process of utilising local knowledge that should be mainstreamed if anything, not the specific knowledge.

The argument can be illustrated by looking back at how LCBCCAP utilises local knowledge. In the case of LCBCCAP local knowledge is utilised through participatory means. By allowing the community and WFPG members to participate in design and implementation, LCBCCAP is enriching the project with local content, which enhances the projects sustainability by ensuring that it is tailor made for that specific context. They do not simply impose a 'local practice' that has proved to work elsewhere. To some extent, this is what they do with the solar driers, but the project has been through a process where the local community has identified it as an appropriate adaptation strategy for the community, and it is further enriched with local content through adapting it to fit into the traditional way of processing fish. There is nothing wrong with learning from other successful practices or projects, but if it is to be used elsewhere it is crucial that it is recognised as appropriate in the receiving community and that it can be adopted and merged into the local context. LCBCCAP has done this through involving the local communities in project. Utilising local knowledge through participatory means is therefore an appropriate method. If it is done successfully it generates a list of advantages for both the programme and the beneficiaries.

The Future Role of Local Knowledge in Climate Change Adaptation

The hypothesis that local knowledge is good for climate change adaptation programmes has to some degree been confirmed by assessing how LCBCCAP has utilised local knowledge. The findings from LCBCCAP and the WFPG illustrates that local knowledge has a positive influence on the climate change adaptation programmes, both for the programme and the beneficiaries. When utilising local knowledge it is nevertheless important to stay critical towards own work and ask the relevant *who* and *whose* questions and to reflect on how own knowledge influences decisions. Climate change adaptation programmes are about enabling individuals or communities to cope or adjust to the impacts of climate change. The centre of attention should be the people. What they need to adapt is most likely best understood by them. Despite climate change being scientific topic, development agencies have a lot to learn from the people living with climate variability and climate change in their everyday lives.

Chapter Eight: Concluding Remarks

Adaptation has become and will continue to be a main focus in the climate change discourse. As experiences of climate change are increasingly being documented it has become evident that climate change is not a worry for tomorrow, but for today. Governments, multilateral organisations and development agencies are developing adaptation strategies to prepare local communities and nations for the predicted changes and the following effects and consequences. What these should focus on and how they should be developed has been a much discussed topic for policy makers as well as scholars. Adger et al. (2003), Blanco (2006), Nyong et al. (2007) have raised awareness of the importance of incorporating local knowledge into adaptation and assert that development agencies have a lot to learn from the people living with climate change. The topic of this study has been how local knowledge can be utilised to enhance climate change adaptation programmes by assessing the Lake Chilwa Climate Change Adaptation Programme (LCBCCAP) in South-eastern Malawi and more specifically the Women Fish Processing Groups (WFPGs). This chapter will summarise the main findings of the study and suggest recommendations where the study has identified limitations in regards to the WFPGs. The prospects for further research on gender and climate change adaptation in the Lake Chilwa Basin will be presented at the end.

Main findings

The Changing Climate in the Lake Chilwa Basin and its Impacts

The climate in the Lake Chilwa Basin region is changing. This is at least what the women of the WFPGs are saying. The main difference in the climate is related to precipitation and irregularities in the rainy season. The women explained that for the past four to five years the rainy season has been unpredictable. It has been unpredictable in two ways. First, the rain does not end and stop when it used to. While a ‘normal’ rain season usually starts in November and ends in March, the rain in 2011-2012 started in late December and the daily rain that is common throughout the season ended in February. Second, during the rainy season it is expected to rain nearly every day. However, in the past years the rainy season has been disrupted by several dry spells. These irregularities are problematic for several reasons. The main issue has to do with subsistence farming. The women and the majority of Malawians rely on their own harvest for food consumption. Maize is the staple food and nearly every

family cultivates their own. However, maize is a demanding crop to cultivate and it relies on regular supply of water to mature. The short wet season and prolonged dry spells within has become a growing challenge for the people living in the basin and Malawi at whole as maize fails to grow. The study is therefore confirming the predictions and concerns of study that stress that it is very likely that climate change will threaten Africa's and Malawi's food security (EAD 2006, Boko et al. 2007). This is an issue that concerns the WFPG members and they are further stressed by the decreasing water level in Lake Chilwa. Because Lake Chilwa is a closed drainage lake, the water level is a direct outcome of precipitation and evaporation of water. The lake is therefore prone to drying up and this has happened nine times in the past century, the last incident being in 1995/1996. The women expressed that they are concerned the lake will dry again soon and this is echoed throughout the communities. If this happens, their main source of income will disappear until the lake refills and fish stock increases. Climate change is therefore a serious concern for rural poor in the Lake Chilwa Basin as their livelihood is heavily dependent on natural resources. While the study cannot confirm if the changes are due to climate variability or climate change, nor that the lake will dry, the challenges are a real threat to the rural poor in the Lake Chilwa Basin. The study indicates that climate change may have devastating effects on the most fundamental needs for the rural poor, such as food security and livelihood. Such issues may further exacerbate into health issues such as malnutrition or starvation.

These findings indicate two important issues that have discussed in chapter six and chapter seven. 1) Understanding how local communities are/or will be affected by climate change is therefore crucial for developing appropriate adaptation strategies, and 2) diversification of livelihood strategies, that goes beyond non-farm and natural resource based employment should be regarded as an important adaptation strategies for Malawi (Boko et al. 2007:452, Njaya et al. 2011:23). As the WFPGs only focus on fish processing, a sector that is threatened by climate change, LCBCCAP may want to consider ways to improve the women's ability to diversify their income.

Adaptation, Adaptive Capacity and the Women's Ability to Diversify Livelihood Strategies

It can however be argued that the WFPG has enhanced the member's ability to diversify their income and to adapt to climate variability and climate change. The women's adaptive capacity was assessed in chapter seven. The findings indicated that the members' involvement in the

WFPG has had a positive effect on their adaptive capacity. This was concluded by assessing the women's financial, social, human, natural and physical capital assets prior to and after becoming a WFPG member. It was found that all assets increased, except natural capital, but that the project had a positive effect on enhancing the value of the fish by utilising the solar fish driers provided by LCBCCAP. The women's income increased substantially and so did their ability to save. Through training, the women gained basic business skills. Some of the women expressed that the training has transformed them into independent and respected business women. Their involvement and participation in the project has increased their social network and consequently enhanced their social capital. Social capital is regarded as an important asset for adaptation and especially for rural poor. This is because relationships of trust and reciprocity are important for coping with natural hazards or emergencies for rural poor. Indeed, the women stated that food and harvest is commonly shared amongst community members during difficult times. The LCBCCAP is a testimony of the importance of vertical social bonds. Adger (2003:396) argues that though adaptation will to a large extent be carried out by people themselves, there are certain services that only governments or organisations can provide. The LCBCCAP provides such a service as they give them valuable training and physical capital, in forms of solar driers, to enhance their adaptive capacity in order to reduce their vulnerability towards climate change.

The pentagon diagram in figure 6.5 gives a clear illustration of the increase in adaptive capacity, but the question remains if it is sufficient to significantly reduce the women's vulnerability towards climate change. The study argues that this may indeed be questionable, especially because of their low diversification of livelihood strategies and their overdependence on natural resources. Only two women had secondary sources of income and only one woman indicated that she wanted to introduce new strategies in her life in order to cope or adapt to climate change. Her plan was to cultivate rice in addition to maize in order to enhance her chance of cultivating enough to support her family, but also this is challenging with erratic rain. Further, only two of the women's husbands were involved in non-natural resource based work. If the poor rainy seasons continue the harvest is threatened and the lake is in danger of drying and consequently their main source of income will vanish. The savings will be a valuable backup at that time if they manage to save sufficient amounts. In addition it was stated that casual daily wage labour, locally known as *ganyu,* is an important source of income during low seasons and when the lake dries up. However, *ganyu* is not a reliable source of income, though it may also be sufficient to cope. Again, low diversification of

livelihood strategies is affecting the women's adaptive capacity negatively. Nonetheless, it may be assumed that business training plays positively in to the women's entrepreneurship. This may lead some women to invest in another business or establish one on their own. A study conducted on fishermen in the basin from the 1970s identified that the wealthiest fishermen in the basin were the ones who had diversified their income. Their earnings from fishing was invested in other businesses, and "such strategies highlight the importance of enhancing or maintain the flexibility of lakeshore livelihoods"(Njaya et al. 2011:23). Again, this may be something that LCBCCAP would want to encourage the women to do as diversification of livelihood strategies would reduce the women's vulnerability to climate change. At the moment, the WFPG is enhancing the women's capacities within a sector that is threatened by climate change – the event the programme is trying to prepare the communities in the basin for. This questions the long-term sustainability of the project the overall ability of the women to adapt to climate change.

The Prospects for Local Knowledge in Climate Change Adaptation

The main objective of the study is to gain an understanding of how local knowledge can enhance climate change adaptation. In chapter seven it was more specifically asked how LCBCCAP utilised local knowledge in the WFPG-project and how it affects the programme and its beneficiaries. The study has identified two ways, though closely linked, LCBCCAP has utilised local knowledge. First, LCBCCAP utilises local knowledge through participatory means. In the implementation strategies for 2011, LCBCCAP claim to use participatory research and participatory management and they acknowledge the importance of including stakeholders in identifying, implementing and monitoring adaptation strategies (LEAD 2011). The findings indicate that participation was also crucial for the development of the WFPG. Representative bodies were involved in identifying the WFPG as an appropriate adaptation strategy for the community. The women have further participated in analysis and their opinions have influenced the design of the project. The women have for example made suggestions to the design of the solar fish driers, which has improved the quality, and they have participated in SWOT analysis. Second, LCBCCAP adaptation strategies are based on strategies that have proved to work elsewhere. The solar fish driers is a technical solution that they believed could be beneficial to introduce in the basin. However, as emphasised Phalira, LCBCCAPs Programme Manager, it is often challenging to introduce new and foreign ideas to rural communities. The feedback from the WFPG members was however positive,

including the response about the improved solutions to process fish introduced by LCBCCAP. The success of the project may be found in the way LCBCCAP has merge 'scientific knowledge' with 'local knowledge'. All but one woman worked with fish processing before joining the WGPG. The traditional way of processing fish is very similar to the way the women process fish now, except they have better tools than increase the quality and value of the product. Hence, the project was rich in local content in the sense that the project was built on a local foundation.

The way in which local knowledge has been utilised has generated several benefits for both the programme and the beneficiaries, as presented in box 7.1. The benefits of utilising local knowledge that have been documented are increased awareness of local development issues and the local environment through dialogues with the community, by having in-depth understanding of local conditions and needs it is possible to design a tailor made adaptation programmes, which increases sustainability. Utilising local knowledge increases efficiency and it is cost-effective, it further improves communication and reduces the chance of conflicts and it was found that it enhances local empowerment.

The study can therefore conclude that local knowledge can be a crucial element in enhancing climate change adaptation programmes. In the case of LCBCCAP, the appropriate way of utilising local knowledge was through participatory means, and merging local practices with technical solutions. An important lesson that can be drawn from the case is that utilising 'local knowledge' does not translate into utilising any 'local knowledge'. As argued by Briggs (2005:109) it is the local embeddedness of local knowledge that makes it so relevant, applicable and even powerful. Utilising local knowledge is not about extracting valuable knowledge from communities and utilising it elsewhere. Though there is nothing wrong with learning from or adopting successful practices, either based on 'local knowledge' or 'scientific knowledge', it is crucial that adaptation strategies are identified together with the communities and further adapted to fit into the local context. When carried out correctly, local knowledge may indeed play a crucial role in climate change adaptation.

Prospects for Further Research

A limitation identified for this thesis is that it lacks an in-depth understanding of the role gender plays in climate change adaptation in the Lake Chilwa Basin. Arora-Jonsson (2011:749) claims that there is a need for context specific case studies to understand the

linkages of gender and climate change. Though it became clear that the WFPG member's gender roles will affect how the women and men in the basin are/will affected by climate change, the study did not gain a sufficient insight into why and how. This is however regarded as an important topic, and may be an interesting research area for another study.

References

Action Aid (2006). *Climate change and smallholder farmers in Malawi: Understanding poor people's experience in climate change adaption*, Action Aid International.

Adger, W. Neil (2003). Social Capital, Collective Action and Adaptation to Climate Change, *Economic Geography*, Vol. 79, No. 4, pp. 387-404.

Adger, W. Neil, Katrina Brown, Declan Conway, Mike Hulme and Saleemul Huq (2003). Adaption to climate change in the developing world, *Progress in Development Studies*, Vol. 3, No. 3, pp. 179-195.

Adger, W.N., S. Agrawala, M.M.Q Mirza, C. Conde, K. O'Brien, J. Pulhin, R. Pulwarty, B. Smit and K. Takahashi (2007). Assessment of adaptation practices, options, constrains and capacity. *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J van der linden and C.E. Hanson, Cambridge University Press: Cambridge.

Agder, W. Neil, Suraje Deesai, Marisa Goulden, Mike Hulme, Irene Lorenzoni, Donald R. Nelson, Lars Otto Naess, Johanna Wolf and Anita Wreford (2009). Are there social limits to adaptation to climate change?, *Climate Change*, Vol. 93, pp.335-354.

Agrawal, Arun (1995). Indigenous and Scientific Knowledge: Some Critical Comments, *Indigenous Knowledge and Development Monitor*, Vol. 3, No. 3, pp. 1-9.

Arora-Jonsson, Seema (2011). Virtue and vulnerability: Discourses on women, gender and climate change, *Global Environment Change*, Vol. 21, pp. 744-751.

BBC (2012). *Malawi devalues kwacha by 33%, leading to panic-buying*. http://www.bbc.co.uk/news/world-africa-17982062 (Accessed 07.05.12).

Bebbington, A. (2000). Reencountering development: livelihood transitions and place transformations in the Andes, *Annals of the Association of American Geographers*, Vol. 90, No. 3, pp. 495-520.

Blanco, Ana V. Rojas (2006). Local initiatives and adaption to climate change, *Disaster*, Vol. 30, No. 1, pp. 140-147.

Boko, M., I. Niang, A. Nyong, C. Vogel, A. Githeko, M. Medany, B. Osman-Elasha, R. Tabo and P. Yanda (2007). Africa. *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge UK, pp. 433-467.

Brett, E. A. (2003). Participation and Accountability in Development Management, *The Journal of Development Studies*, Vol. 40, No. 2, pp. 1-29.

Briggs, John (2005). The use of indigenous knowledge in development: problems and challenges, *Progress in Development Studies*, Vol. 2, No. 2, pp.99-114.

Brooks, Nick W. Neil Adger (2005). Technical Paper 7: Assessing and Enhancing Adaptive Capacity. In B. Lim and E. Spanger-Siegfried (Eds.) *Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies and Measures*, pp 165-181. UNDP-GEF. Cambridge University Press.

Bryman, Alan (2008). *Social Research Methods*, Oxford: Oxford University Press.

Carr, Stephen (2012). Has Malawi's Climate Changed, Powerpoint presentation, Tuesday 24th April, Zomba

Central Intelligence Agency (2011). *The world factbook: Malawi, Central Intelligence Agency*, https://www.cia.gov/library/publications/the-world-factbook/geos/mi.html (Accessed 13.09.11).

Chambers, Robert (1994). The Origins and Practices of Participatory Rural Appraisal, *World Development*, Vol. 22, No. 7, pp.953-967.

Chapotera, Mphatso (2012). *Stream flow and water level monitoring report*, Zomba:WorldFish Centre.

Chiwaula, Levison S. and Regson Chaweza (2010). *A fish value chain analysis of Lake Chilwa Basin in Malawi, A draft technical report submitted to the WorldFish Centre*, Zomba: WorldFish Centre.

Denscombe, Mark (2007). *The Good Research Guide for Small-Scale Social Research Projects*, Third Edition, Maidenhead: Open University Press.

Dulal, Hari Bansha, Gernot Brodnig, Hermanta Kumar Thakur, Charity Green-Onoriose (2011). Do the poor have what they need to adapt to climate change? A case study of Nepal, *Local Environment*, Vol. 15, No. 7, pp.621-635.

Dodman, David and Diana Mitlin (2011). Challenges for Community-Based Adaption, *Journal of International Development*, Available through: Wiley Online Library, (accessed 06.04.08).

EAD (2000). *Lake Chilwa Wetland State of the Environment*, Lilongwe: Environmental Affairs Department.

EAD (2006). *Malawi's National Adaptation Programmes of Action (NAPA)*, Lilongwe: Environmental Affairs Department.

EAD (2010). *Malawi State of Environment and Outlook: Environment for Sustainable Economic Growth*, Lilongwe: Environmental Affairs Department.

Ellis, Frank (2000). *Rural Livelihoods and Diversity in Developing Countries*, Oxford University Press: Oxford

Engle, Nathan L. (2011). Adaptive capacity and its assessment, *Global Environmental Change*, No. 21, pp. 647-656.

Evans, Peter (1996). Introduction: Development Strategies across the Public-Private Divide, *World Development*, Vol. 24, No. 6, pp. 1019-1932.

GoM (2009). *Lake Chilwa and Mpoto Lagoon, Fisheries management plan*, Government of Malawi.

GoM (2010). *Statistical Yearbook: 2010*, Zomba: National Statisical Office.

GoM (2011). *GDPFlash, Second Edition*, Zomba: National Statistical Office.

Goodwin, Mark (2006). Constructing and Interpreting Qualitative Data, in Alan Bond (ed.) *Your Master's Thesis*, Abergele: Studymates Limited.

IPCC (2012). *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*, [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge: Cambridge University Press.

Jakimow, Tanya (2008). Answering the critics: the potential and limitations of the knowledge agenda as a practical response to post-development critiques, *Progress in Development Studies*, Vol. 8, No. 4, pp. 311-323.

Jury, M. R., and N. D. Mwafulirwa (2002). Climate variability in Malawi, part 1: Dry summers, statistical associations and predictability, *Int.J. Climatol*, Vol. 22, pp. 1289–1302.

Kalanda-Joshua, Miriam, Cosmo Ngongondo, Lucy Chipeta and F. Mpembeka (2011). Integrating indigenous knowledge with conventional science: Enhancing localised climate and weather forecasts in Nessa, Mulanje, Malawi, *Physics and chemistry of the earth*, Vol 36, pp. 996-1003.

Kelly P.M. and W.N. Adger (2000). Theory and practice in assessing vulnerability to climate change and facilitating adaptation, *Climate Change*, No. 47, pp. 325-352.

Klooster, Daniel James (2002). Toward Adaptive community forest management: integrating local forest knowledge with science, society and development, *Economic Geography*, Vol. 78, No. 1, pp-43-70.

LEAD (n/a). *Lake Chilwa Basin Climate Change Adaptation Programme: An Overview*, Zomba: LEAD

LEAD (2011). Lake Chilwa Basin Climate Change Adaptation Programme: Implementation Strategy for 2011, Zomba: LEAD.

LEAD (2012a). *Climate Change Toolkit*, Zomba: LEAD

LEAD (2012b). *Lake Chilwa Basin Climate Change Adaptation Programme: Implementation Strategy 2012*, Zomba: LEAD.

LEAD (Leadership for Environment and Development), Forestry Research Institute of Malawi and national Herbarium and Botanical Gardens of Malawi (2009). *Addressing Climate Change by Building Social and Ecological Resilience in the Lake Chilwa Basin*, Funding proposal submitted to the Royal Norwegian Embassy, Zomba:LEAD.

Malawi Times (2012). *Malawi tobacco output expected to drop by 50 per cent*, http://www.malawitoday.com/news/123665-malawi-tobacco-output-expected-drop-50-percent (accessed 15.05.12)

Maloya, Hastings (2005). *There is Wealth in Our Wetlands, a Call for their Conservation, Mulanje Mountain Conservation Trust*, www.ramsar.org/pdf/wwd/5/wwd2005_rpt_malawi1.pdf *(Accessed 16.09.11).*

MacGregor, Sherilyn (2010). A strange silence still: the need for feminist social research on climate change. *The Sociological Review*, Vol. 57, pp.124-140

McSweeney, C., M. New and G. Lizcano (2012). *UNDP Climate Change Country Profile: Malawi*, http://country-profiles.geog.ox.ac.uk (Accessed 13.09.11).

MNREE (2010). *Revised decentralized environmental management guidelines*, Ministry of Natural Resources Energy and Environment.

MoDPC (2009*). Summary: Malawi Growth and Development Strategy, From Povery to Prosperity 2006-2011*, Ministry of Development Planning and Cooperation.

Nagoli, Joseph (2010). *Lake Chilwa Basin Climate Change Adaptation Programme: Livelihood Analysis Report*, Zomba: WorldFish Centre.

Nelson, R, P. Kokic, S. Crimp, P. Martin, H. Meinke, S.M. Howden, P. de Voil, U. Nidumolu (2009a). The vulnerability of Australian rural communities to climate variability and change: Part II – Integrating impacts with adaptive capacity, *Environmental Science & Policy*, Vol. 13, pp. 18-27.

Nelson, R, P. Kokic, S. Crimp, P. Martin, H. Meinke, S.M. Howden, P. de Voil, U. Nidumolu (2009b). The vulnerability of Australian rural communities to climate variability and change: Part II – Integrating impacts with adaptive capacity, Appendix for online publication, *Environmental Science & Policy*, Vol. 13, pp. 18-27.

Nelson, Valerie and Tanya Stathers (2009).Reslience, power, culture, and climate: a case study from semi-arid Tanzania, and new research directions: a case study from semi-arid Tanzania, and research directions, *Gender and Development* Vol. 17, No. 1. Pp.81-94.

Njaya, Friday (2011). Integrating environments in fisheries- co-management and traditional knowledge helping shift Lake Chilwa from recession to recovery, pp. 58-63, in Bass, James L.L. Banda, Sosten Chiotha, Joseph Kalowekamo, Themba Kalua, Daisy Kambalame-Kalima, Boyd Hamella, Michael Mmangisa, Gibson Mphepo, Nyuma Mughogho, Dennis Mulebe, Friday Njaya, Elliot Phiri, Benon Yassin, and Gil Yaron (2011). *Mainstreaming the environment in Malawi's development: experience and next steps*, London: IIED.

Njaya, Friday J. (2001). Review of Management Measures for Lake Chilwa, Malawi, UNU-Fisheries Training Programme http://www.unuftp.is/static/fellows/document/fridayprf.pdf (Accessed 04.05.12).

Njaya, Friday, Katherine A. Snyder, Daniel Jamu, John Wilson, Clive Howard-Williams, Edward H. Allison and Neil L. Andrew (2011). The natural history and fisheries ecology of Lake Chilwa, southern Malawi, *Journal of Great Lakes Research*, Vol 37, pp. 15-25.

Nyondo, Ephraim (2012). A mystery called climate change, *Nation on Sunday*, January 22. 2012, pp. 8-9.

Nyong, Anthony, Francis Adesina and Balgis Osman Elasha (2007). The value of indigenous knowledge in climate change mitigation and adaption strategies in the African Sahel, *Mitig Adapt Strat Globa Change*, Vol. 12, pp. 787-797.

O'Brien, Karen, Siri Eriksen, Ane Schjolden, Lynn Nygaard (2004).What's in a word? Conflicting interpretations of vulnerability in climate change research, CICERO Working Paper 2004:04, CICERO.

Pelling, Mark and Chris High (2005). Understanding adaptation: What can social capital offer assessments of adaptive capacity?, *Global Environmental Change*, Vol. 15, pp. 308-319.

Prakash, Sanjeev and Per Selle (2005). Theories of Social Capital, Civil Society, and the State. Crossing the Bridge from North to South - And Back Again, Global Knowlede, No 1. http://www.siu.no/eng/Front-Page/Global-knowledge/Issues/No-1-2004/Theories-of-Social-Capital-Civil-Society-and-the-State (Accessed 02.05.12).

Rahnema, Majid (1990). Participatory Action Research: The "last Temptation of Saints" Development, *Alternatives: Global, Local, Political*, Vol. 15, No. 2, pp. 199-226.

Rambaldi, Giacomo, Chambers, Robert, McCall, Mike and Fox, Jefferson (2006). Practical Ethics for PGIS Practitioners, Facilitators, Technology Intermediaries and Researchers, *Participatory Learning and Action*, Vol. 54, pp. 106–113

Ramsar (2012). *About the Ramsar Convention*, http://www.ramsar.org/cda/en/ramsar-about-about-ramsar/main/ramsar/1-36%5E7687_4000_0__ (Accessed 03.04.12)

Sillitoe, Paul (2006). Introduction: Indigenous Knowledge in Development, *Anthropology in Action*, Vol. 13, No. 3, pp.1-12.

Silva, Sonya and Thembela Kepe (2010). An examination of 'Participation' and 'Sustainability' in a Food Security Project among the Rural Poor in Northwestern Tanzania, *African and Asian Studies*, Vol. 9, pp.31-54.

Simtowe, Franklin Peter (2010). Livelihoods diversification and gender in Malawi, *African Journal of Agricultural Research*, Vol. 5, No. 3, pp.204-216.

Smith, Barry and Johanna Wandel (2006). Adaption, adaptive capacity and vulnerability, *Global Environment Change*, Vol. 16, pp. 282-292.

Smith, Thomas Aneurin (2011). Local knowledge in Develoment (Geography), Geography Compass, Vol 5, Pt 8, pp. 595-609.

Stringer, Lindsay C., Jen C. Dyer, Mark S. Reed, Andrew J. Dougill, Chasca Twyman and David Mkwambisi (2009). Adaptation to climate change, drought and desertification: local insight to enhance policy in southern Africa, Environmental Science & Policy.

UNDP (2011). *Human Development Report 2011: Sustainability and Equity: A Better Future for All,* Hampshire: Palgrave Macmillan.

UNDP (2012). *Malawi: Country Profile: Human Development Indicators,* http://hdrstats.undp.org/en/countries/profiles/MWI.html (Accessed 02.04.12).

UNEP (2007). *GEO 4. Environment for development*, Malta:UNEP.

UNESCO (2003). What is Local Knowledge, UNESCO http://portal.unesco.org/science/en/ev.php-URL_ID=2034&URL_DO=DO_TOPIC&URL_SECTION=201.html (accessed 04.04.11).

UNFCCC (2011). *Report of the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010*, UNFCC, http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf#page=4 (Accessed 24.05.12).

UNFCCC (2012). National Adaptation Programmes of Action (NAPAs), http://unfccc.int/national_reports/napa/items/2719.php (Accessed 23.05.12).

Wikipedia (2011). Brachystegia, http://en.wikipedia.org/wiki/Brachystegia (Accessed 15.05.12).

Woodlock, Michael and Deepa Narayan (2000). Social capital: Implications for Development Theory, Research, and Policy, *The World Bank Research Observer*, Vol. 15, No. 2, pp. 225-249.

World fish Centre (2008).Climate Change - Projects. http://www.worldfishcenter.org/wfcms/HQ/article.aspx?ID=677 (Accessed 13.09.11).

XE (2012). http://www.xe.com/ucc/convert/?Amount=1&From=USD&To=MWK (Accessed 04.05.12).

Appendices

Appendix 1: Interview guide for WFPG

Date:
Location:
WFPG:
Demographics
Name (optional):
Age:
Marital Status: ☐ Unmarried ☐ Married ☐ Divorced ☐ Widow ☐ Separated
Dependents: ☐ 1-3 ☐ 4-6 ☐ 7-9 ☐ 10-12
Level of education: ☐ None ☐ Primary 1-5 ☐ Primary 6-8 ☐ Secondary 1-2 ☐Secondary 3-4 ☐ Tertiary
Can you read and write: ☐ Yes ☐ No
Husbands occupation: ☐ Fish sector ☐ Farmer ☐ Trader ☐ Other……..
Head of household: ☐ Wife ☐ Husband ☐ Other ……
Information about women group:
Name of group:
Position within the group: ☐ Executive ☐ Member

1. How did you get involved in the project?
2. Did you participate in meetings prior to starting the project to identify what projects to get involved in?
   ☐ Yes ☐ No
3. Have you been able to influence what the project is going to be like
   ☐Yes ☐ No
   If so, how?
4. Have you been able to make suggestions in order to improve the project?
   ☐ Yes ☐ No
   If yes, what did you suggest?
5. At what time were you able to come with suggestions?
   ☐ Prior to implementing project ☐ After project was implemented ☐ Both
6. Have you seen that the suggestions you present have been implemented?
   ☐ Yes ☐ No
7. Do you feel like the suggestions you made were respected? ☐ Yes ☐ No
8. Did you participate in training and seminars? ☐ Yes ☐ No
   If so, what kind of training and seminars have you participate in?
9. Have you participated in monitoring and/or evaluating the project? ☐ Yes ☐ No
   If yes, what are the outcomes of these sessions?
10. What is your main income-generating activity?
    ☐ Fish processing ☐ Farming ☐ Shopkeeper ☐ Other……..
11. What kind of income generating activities did you do before the project?
    ☐ Fish processing ☐ Farming ☐ Shopkeeper ☐ Trader ☐ Other…….
12. Besides fish processing, do you do any other income-generating activities now?
    ☐None ☐ Farming ☐ Shopkeeper ☐ Trader ☐ Other……
13. If interviewee worked with fish processing before, how did you use to process fish?
14. What do you see as the benefits of using solar driers, improved smoking kilns and packaging the fish?
15. Do you feel like you benefit from the fish-processing project? ☐ Yes ☐ No
    If yes, how?
16. Are there any challenges related to being part of the project? ☐Yes ☐ No
    If yes, what?
17. Are there any benefits of working together in a group? ☐ Yes ☐ No
    If yes, what are the benefits?
18. Are there any challenges of working together in a group? ☐ Yes ☐ No
    If yes, what are the challenges
19. Has this project changed your life in any way? ☐ Yes ☐ No
    If yes, how?
20. Has this project changed the way you view yourself and your own capabilities? ☐ Yes ☐ No
    If yes, how?
21. Has this project changed the way your family view you? ☐ Yes ☐ No
    If yes, how?

22. Has this project changed the way the community view you? ☐ Yes ☐ No
    If yes, how?
23. Do you think the climate is changing? ☐ Yes ☐ No
24. Have you experienced any changes in the climate? ☐ Yes ☐ No
25. What have you experienced? ☐ Change in rainfall pattern ☐ Higher temperatures ☐ dry spells ☐ More drought ☐ More floods ☐ Other……..…
26. What is the difference?
27. When did you start experiencing these changes?
28. How has this affected you?
29. Have you made any changes in your life because of changes in the climate?
    ☐ Yes ☐ No
    If yes, how?
30. If yes, how has this helped you?
31. Are there any changes that you have not made, but that you would like to make? ☐ Yes ☐ No
    If yes, what?
32. If you need help, where do you go?
33. Does the community work together during difficult times? ☐ Yes ☐ No
    If yes, how?
34. Do you think climate change affects men and women differently? ☐ Yes ☐ No
    If yes, how?
35. Do you consider climate change to be a serious threat to you? ☐ Yes ☐ No
    If yes, how?
36. Why do you think the climate is changing?
37. Where did you learn about climate change?
    ☐ Seminars ☐ Market ☐ Church ☐ Radio ☐ LCBCCAP ☐ Family members ☐Community meetings ☐ Personal experience ☐ Other…….
38. Were you affected when the lake dried up in 1995 or at other occasions?
    ☐ Yes ☐ No
    If yes, how?
39. What did you do when the lake dried up?
40. Is the fish processing project helping you to deal with the problems that have occurred due to changes in the climate, such as unpredictable rainfall, dry spells, dry lake, less fish and higher temperatures? ☐ Yes ☐ No
    If yes, how?
41. How much money do you earn per week from fish processing?
42. If interviewee worked with fish processing, how much money did you use to earn from fish processing per week before the project?
43. Are you using the bank account set up by LCBCCAP? ☐ Yes ☐ No
44. Are you saving money? ☐ Yes ☐ No
    If yes, how much are you saving per week?
45. Where do you save money?
46. What are you saving for?
47. Before the project, were you able to save money? ☐ Yes ☐ No
    If yes, how much would you save per week?
48. Do you have any further suggestions to how LCBCCAP can assist you to adapt to the changes in your environment?
49. Any other comments?

Appendix 2: Interview guide for Focus Groups with WFPGs

Date:
Location:
WFPG:

1. When did you first hear of the project?
2. When was this group established?
3. Why did you join the project?
4. How many members are there in the group?

Participation

5. Did the group participate in meetings, prior to starting the project, to identify what projects to get involved in?
6. Did the group participate in training and seminars?
   If so, what kind of training and seminars has the group participate in?
7. Have you participated in monitoring and/or evaluating the project?
   What are the outcomes of these sessions?
8. Have you been able to make suggestions in order to improve the project?
9. Have you seen that the suggestions you present have been implemented?
10. Does the group think that LCBCCAP respect and values the suggestions that the group presents?

Fish Processing

11. How many in the group worked with fish processing before the project?
12. What is the major difference between the old and new methods?
13. Is there anything that is better about the old methods?
14. What do you consider to be the benefits of using the solar driers, improved smoking kilns and packaging the fish compared to old methods?
15. What are the benefits of being in the project?
16. What are the challenges of being in the project?

Climate Change

17. Do you think the climate is changing?
18. Have you experienced any changes in the climate?
    If yes, what have you experienced?
19. How has this affected you?
20. Has it had an effect on the whole community?
21. Have you made any changes in your life because of changes in the climate?
    If yes, how?
    How has this helped?
22. Are there any changes that you have not made, but that you would like to make?
    If yes, what?
23. Do you think climate change affects men and women differently?
    If yes, how?
24. Do you consider climate change to be a serious threat to you and your community?
    If yes, how?
25. Why do you think the climate is changing?
26. Where did you learn about climate change?
27. Were you affected when the lake dried up in 1995 or at other occasions?
    If yes, how?
28. What did you do when the lake dried up?

29. Is fish processing helping you to deal with the problems that have occurred due to changes in the climate, such as unpredictable rainfall, dry spells, dry lake, less fish and higher temperatures? If yes, how?
30. Do you have any further suggestions to how LCBCCAP can assist you to adapt to the changes in your environment?
31. Any other comments?

Appendix 3: Interview guide for LCBCCAP partners (DoF)

Location:
Date:
Name:
Occupation:

1. How are you connected to the LCBCCAP and the women groups that work as fish processors?
2. How long have you been working with LCBCCAP?
3. From your point of view, does LCBCCAP use local knowledge in the projects?
4. To what extents have the local community participated in designing the projects?
5. To what extents does LCBCCAP consider the women groups' suggestions, concerns and/or feedback concerning the project?
6. From your point of view, what are the benefits of utilising local knowledge?
7. Do you identify any challenges of utilising local knowledge?
8. What do you see as the women´s main challenges when it comes to climate change?
9. To what extent does the project help the women to adapt to climate change?
10. From your point of view, does climate change affect women and men differently?
11. From your point of view, does the project empower the women?
    a. If so, how?
12. Do you have any suggestions to other projects that LCBCCAP could have to help the community to adapt to climate changes?
13. Do you have any other comments?

Appendix 4: Interview guide for LCBCCAP (LEAD and WFC)

Date:
Name:
Occupation:

Local Knowledge

1. How do you define local knowledge?
2. Local knowledge has been recognised as a magic bullet for development by many. Why do you think this is and what is your opinion about local knowledge and development?
3. The need to consider local knowledge in climate change adaptation has been recognised by scholars as well as development agencies. From your point of view, is local knowledge important when it comes to climate change adaptation? Why?

Women Fish Processing Clubs

4. Do you utilise local knowledge in the fish processing project?

If yes, how?

5. What are the benefits of utilising local knowledge?
    a. What are the benefits for LCBCCAP
    b. What are the benefits for the community?
6. What are the challenges?
    a. What are the challenges for LCBCCAP?
    b. What are the challenges for the community?
7. What kind of information does LCBCCAP use when designing and running the fish processing project?
    a. What role does scientific knowledge play?
    b. What role does local knowledge play?
    c. How can local knowledge contribute to existing scientific knowledge?

Participation

8. What structures have been put in place by LCBCCAP to ensure local participation in the projects?
9. How does LCBCCAP interact with local communities?
10. Does the community member influence what projects are started and how they are designed?
    a. What are the benefits and challenges related to allowing the community influence what projects you should have?

Climate Change and Adaptation

11. What do you consider to be the community's main challenge when it comes to climate change and adaptation?
12. Do you think women and men are affected differently by climate change?
13. How does the project help people adapt to climate change?
    a. Would you say that the project increases the people's resilience towards climate change?
14. Does WFC collaborative with existing local governmental and social structures?
    a. If so how?
    b. What are their roles?
    c. How effective has it proven to be?
    d. What are the benefits and challenges?
15. How does WFC ensure that gender is considered in the projects?
16. Any other comments to the topic that you find important?